Sir ISAAC NEWTON's PHILOSOPHY

Explained

For the Uſe of the LADIES.

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Explain'd

For the Uſe of the LADIES.

In Six DIALOGUES

ON

LIGHT and COLOURS.

From the *Italian* of Sig. *Algarotti.*

VOLUME I.

Quæ legat ipſa Lycoris. VIRG. ECL. X.

LONDON:

Printed for E. CAVE at St. *John*'s-*Gate*, and ſold alſo by Meſſrs. BRINDLEY in *Bond-ſtreet*, DODSLEY in *Pall-mall* HARDING in St. *Martin*'s-*lane*, MILLER in the *Strand*, SHUCKBURGH in *Fleet-ſtreet*, BIRT in *Avemary-Lane*, RIVINGTON in St. *Paul*'s *Church-Yard*, GRAY, HETT, and DAVISON in the *Poultrey*, and CLARKE at the *Royal-Exchange*.

M,DCC,XXXIX.

MVSEVM
BRITAN
NICVM

TO

Monſ. de FONTENELLE.

IF you addreſſed your ingenious and entertaining *Dialogues* to the illuſtrious *Dead*, who had firſt given you the Idea of that Work, and therefore thought yourſelf obliged to ſeek your Hero even in the Obſcurity of the Tomb; how much greater Reaſon have I to dedicate theſe Diſcourſes to one of the moſt illuſtrious among the *Living*, whom I am indebted to for the Example which firſt ſet me upon compoſing them, and who has given me ſo perfect a Model of polite Wit and agreeable Writing?

Your *Plurality of Worlds* firſt ſoftened the ſavage Nature of Philoſophy, and called it from the ſolitary Cloſets and Libraries of the Learned, to introduce it into the Circles and Toilets of Ladies. You firſt interpreted to the moſt amiable Part of the Univerſe thoſe Hieroglyphics, which were at firſt only for Initiates; and found a happy Method to imbelliſh and interſperſe with the moſt beautiful Flowers a Field, which once ſeemed incapable of producing any Thing but the moſt rugged Thorns and perplexing Difficulties. You may be ſaid to have committed the Care of revolving the Heavens to *Venus*, and the Graces, inſtead of thoſe Intelligences to whom Ignorance had anciently aſſigned that Office.

The Succeſs was anſwerable to the Beauty and Novelty of the Undertaking. That half of our World, which always commands the Votes of the other, has given its Approbation to your Book, and in the moſt agreeable manner conſecrated it to Poſterity.

May I venture to flatter myſelf, that my *Light* and *Colours* will have the ſame Fate as your Worlds? If a Deſire of pleaſing thoſe who afford us ſo much Pleaſure, were ſufficient to make its Fortune, I ſhould have nothing to envy you. But I am too ſenſible of the very many Defects that attend my Performance, Defects that I cannot help lamenting; for not to ſay any Thing of your Talents, and that happy Art of rendering every Thing you undertake entertaining and agreeable, the Plu-

rality of Worlds, which you have chose for your Subject, seems of all others to present the most pleasing and elegant Images, and is therefore the most agreeable to your Dialogists, that the vast Field of Philosophy could ever supply you with. It presents to the Mind nothing less than the Stars and Planets, the grandest and most shining Objects of the Universe. There are but few of the subtile Enquiries of Science, into which you are obliged to enter. The Arguments, upon which your Opinion is founded, do not carry such a Certainty in them, as to make the Conversation grow languid.

I have endeavoured to set Truth, accompanied with all that is necessary to demonstrate it, in a pleasing Light,

Light, and to render it agreeable to that Sex, which had rather *perceive* than *underſtand*. *Light* and *Colours* are the Subject of my Dialogues; a Subject, which, however lively and agreeable it may ſeem, is not in itſelf either ſo pleaſing or ſo extenſive as your Worlds. I am obliged to deſcend to many difficult and minute Particularities of Knowledge; and my Arguments are unhappily inconteſtable Experiments, which muſt be explained with the greateſt Accuracy imaginable. It was indeed juſt, that the Ladies, who by your Work had been made acquainted with the great Change introduced by *Des Cartes* into the thinking World, ſhould not be ignorant of the new, and 'tis probable the laſt Change, of which the illuſtrious Sir *Iſaac Newton* was the Author. But it was extremely difficult to receivilize

this ſavage Philoſophy, which in the Paths of Calculation and the moſt abſtruſe *Geometry* was returning more than ever to its ancient Auſterity. You have embelliſhed the *Carteſian* Philoſophy; and I have endeavoured to ſoften the *Newtonian*, and render its very Severities agreeable.

However, the abſtruſe Points, upon which I have been obliged to treat, were only ſuch as are abſolutely neceſſary, and always interſperſed with ſomething that may relieve the Mind from that Attention which they require. In the moſt delightful Walk we are ſometimes glad to find a verdant Turf to repoſe ourſelves upon. Lines and mathematical Figures are entirely excluded, as they would have given theſe Diſcourſes too Scientific an

Air, and appeared formidable to thoſe, who to be inſtructed muſt be pleaſed. Mathematical Terms are as much as poſſible avoided; and if ever any do occur, they are explained by the Aſſiſtance of the moſt familiar Objects. The Difficulties raiſed againſt any particular Experiment, the Hiſtory of optical Inventions, metaphyſical Doubts, and the various Opinions of different Philoſophers, preſerve the Subject from that continued Uniformity, which would make it diſagreeable and tedious. I have endeavoured as much as poſſible to render it lively, and make my Readers intereſt themſelves in it as they would in a Compoſition for the Theatre. Is there any Thing (eſpecially where Ladies are concerned) in which a Writer ſhould omit any Endeavours to move the Heart?

The *marvellous*, of which the Heart always deſirous of being affected is ſo fond, happily ariſes in true Philoſophy of itſelf, without the help of Machines. I have made a ſort of Change or Cataſtrophe in the Philoſophy of my Marchioneſs, who is at firſt a *Carteſian*, afterwards a Proſelyte to *Malebranche*, and at laſt obliged to embrace the Syſtem of that Perſon, who ought to be placed at the Head of his Species, if Superiority and Rank among Mankind were determined by Strength of Genius and the moſt comprehenſive Knowledge. This great Philoſopher's general Syſtem of Attraction is not omitted, becauſe it has a natural Connexion with the particular Attraction obſerved betwixt Bodies and Light. Thus theſe Dialogues may be conſidered as a complete

plete Treatiſe of the *Newtonian* Philoſophy. The Sanctuary of the Temple will always be reſerved for the Prieſts and Favourites of the Deity; but the Entrance and its other leſs retired Parts will be open to the profane.

The Style I have endeavoured to follow is what I believed moſt proper for Dialogue, clear, conciſe, interrupted, or interſperſed with Images and Turns of Wit. I have taken the utmoſt Care to avoid thoſe perplexed and long Periods cloſed by the Verb, which only ſerve to run the Reader out of Breath, and are beſides repugnant to good Senſe, and much leſs agreeable to the Genius of our Language than is generally believed, and certainly cannot be agree-

able

able to the Genius of thoſe, who write with an Intention of being underſtood. I have left them entirely to thoſe, who forſake the [a] *Saggiatore* for the [b] *Fiammetta*, together with thoſe antique and obſolete Words which conſtitute ſo great a Part both of their Knowledge and Delight. The Count *di Caſtiglione*, in his *Courtier*, two Centuries ago, ventured to write in ſuch a Manner, as to be underſtood by his Contemporaries, and throwing aſide the Affectation of *Gothic* Terms, adapted his manner of writing to the Forms of Speech in Uſe among the polite and well bred Perſons of his Time. *Cuſtom*, the ſovereign Judge in all Languages, (except perhaps our own) was

[a] An Epiſtle from *Galileo* to *Virginius Cæſarinus*, in which the Author gives a very elegant Expoſition of his Syſtem of Phyſics and Aſtronomy.

[b] A Romance, by *Boccace*.

his

his Guide; and thus he enriched us with the fineſt Piece (as far as regards the Style) which the *Italian* Language has to boaſt of. For what Reaſon ſhould I think myſelf obliged to make uſe of the antiquated Diſcourſes of ſome clamorous Haranguer of four hundred Years ſtanding, as a Model for a Work of Philoſophy and Politeneſs; and rather than talk to Ladies in the Language of the preſent Age, addreſs my Diſcourſe to the Devotees of the thirteenth Century?

This minute Diſſertation I thought in ſome Meaſure due to yourſelf, to let you ſee how little I have neglected in a manner of Writing, which may be regarded as your own. Nor was it leſs due to my Countrymen, ſince this

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this Work, whatever it be, is written in their original Language. Young Mathematicians, in giving the Solution of a Problem, generally deſcribe the Steps by which they inveſtigated it: It is only thoſe of an eſtabliſhed Reputation who are permitted to give the ſimple Solution, and leave to others the Care of finding by what Means they attained it.

I would not however appear to ſet a greater Value upon this Work than perhaps the World will think it deſerves, or ſuppoſe myſelf to have given a perfect Solution of this Problem. I am too well acquainted both with myſelf, and the Difficulty of the Enterprize, to entertain ſo high an Opinion of the Performance. I have perhaps only ſeen

ſeen the Method, which ought to be followed, and yet have not followed it myſelf. *Raphael* and *Guercino* had nearly an equal Knowledge of the Preparations neceſſary for the right Deſigning of a Figure, and yet were extremely unequal in the Execution of it.

Whatever may be the Succeſs of my Undertaking, the Ladies, for whom this Work is principally intended, ought at leaſt to think themſelves obliged to me, if I have procured them a new kind of Amuſement, which others may perhaps carry to a greater Degree of Perfection; and if I have brought into *Italy* a new Mode of cultivating the Mind, rather than the preſent momentary Faſhion of adjuſting their Head-dreſs and placing their

their Curls. Travellers ſhould be the *Importers* of Wit, and of thoſe reciprocal Advantages, which different Nations even in this reſpect have over each other. Happy the Society formed upon the *Italian* Fancy, the *French* Politeneſs, and *Britiſh* good Senſe!

We ought to think ourſelves obliged to your Nation, and yourſelf in particular, for giving us an Example to render common and eaſy what was once myſterious and difficult, and to write in our own Language what by a ſuperſtitious Veneration was appropriated to the *Latin*, and at the ſame Time perplexed with *Greek*, that moſt formidable Weapon of Pedantry. We may in this reſpect caſt the ſame Reproach on the *Italians* as

Mr.

Mr. *Pope* does in another Caſe on the *Engliſh* in his fine Prologue to *Cato*.

Our Scene precariouſly ſubſiſts too long
On French *Tranſlation and* Italian *Song*,
Dare to have Senſe yourſelves, aſſert the Stage,
Be juſtly warm'd with your own native Rage.

If we except ſome Tranſlations from the *French*, there is nothing among us but Songs and Collections of Verſes, which every Day overſpread us like a Deluge, and are the Torments of our Age. In the modern Books, written in the *Italian* Language, the Ladies can find nothing but Sonnets full of a metaphyſical Love, which I ſuppoſe muſt affect them as little as the anti-

quated

quated Expreſſions of ſuperannuated *Cicisbei*. Let the Age of Realities once more ariſe among us, and Knowledge inſtead of giving a rude and ſavage Turn to the Mind, and exciting endleſs Diſputes and wrangling upon ſome obſolete Phraſe, ſerve to poliſh and adorn Society. I have at leaſt opened the Way to ſomething, which is neither Grammar nor Sonnet; and I ſhall flatter myſelf to have done much more, if what the Ladies inſpired me with, has the good Fortune to meet with your Approbation.

CON-

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CON-

The First Dialogue.

A general Idea of Phyſics, and an Explanation of the moſt remarkable Hypotheſes concerning Light *and* Colours.

THE very ſame Reaſon that led me every Day to a Concert of Muſic, a gay and elegant Entertainment, a Ball, or the Theatre, induced me to write an Account of the Manner in which I paſſed my Time laſt Summer in the Country with the Marchioneſs of *E*——, and has thus from an idle and uſeleſs Member of Society, rendered me an Author. And the natural Deſire that every Author has to appear in print (whatever theſe Gentlemen may tell us in their long Pre-

faces) engages me at preſent to publiſh this Account. It is entirely philoſophical, and compoſed of certain Diſcourſes which I had with that polite Lady on the Subject of Light and Colours. Some will, I make no doubt, condemn me for having paſſed my Time ſo ill with a Lady; and indeed I have condemned myſelf for it. But if they knew what an engaging Manner the Marchioneſs has of obliging every one to what ſhe deſires, I am perſuaded they would forgive me, even if I had read her *Guicciardini*'s [a] Hiſtory of the Wars of *Piſa*, if ſhe could have deſired it. But however inexcuſable my Error might be, I conſtantly endeavour'd to amend it, whenever I could diſengage myſelf a little from Light and Colours: And indeed both the Beauty of the Marchioneſs and the Nature of the Place (which ſeemed formed to ſupport what ſhe ha

[a] An *Italian* Hiſtorian very prolix and tedious. It was a Saying of Dr. *Donne*'s, that if *Moſes* had wrote like *Guicciardini*, the whole World would not have been big enough to contain the Hiſtory of its own Creation.

every

every where given Birth to) inſpired a Diſcourſe quite different from that of Philoſophy. The little Peninſula of *Sirmione*, (the Country of the polite *Catullus*) and thoſe Mountains which have ſo often repeated the fine Verſes of [a] *Fracaſtorius*, two remarkable Points (if I may uſe the Expreſſion) in the poetical Geography, formed a diſtant Proſpect to a fine Seat placed on an eaſy Aſcent that was watered below with the clear Streams of the *Benaco* [b], which by its great Extent and the roaring of its Waves, ſeems to rival the Ocean.

[a] *Jerom Fracaſtorius* was born of a noble Family at *Verona* in *Italy*, about the Year 1483. He ſtudied Phyſic, 'till a few Years before his Death, when he devoted himſelf entirely to the Study of polite Learning. *Mathematics*, *Aſtronomy* and *Coſmography*. He died of an Apoplexy in 1553, and was interred in the Church of St. *Euphemia* at *Verona*, where in 1559 he had a Statue erected to him by Order of that City. His poetical Works are much admired, the principal of which are his *Syphilis*; *Joſeph* an Epic Poem in 2 Books, but left unfiniſhed at his Death; and his *Alcon ſeu de Curâ Canum Venaticorum*. See *his Life prefixed to his Works*, *Joann. Imperialis Muſæum Hiſtoricum*. Pag. 16. *Les Eloges des Hommes Savans, tirez de l'Hiſtoire de M. de* Thou. *Tom.* 1. Pag. 189.

[b] A Lake in the Territories of *Venice*, now called *Lagodi Garda*.

The Orange Trees that diffuſed their Odours along the Banks, and perfumed the Air all around with a delightful Fragrance, the Coolneſs of the Woods, the Murmur of Fountains, the Veſſels that ſpread their Sails along the cryſtal Lake, each of theſe agreeable Objects would have alternately raviſhed my Senſes, if the Goddeſs of this delightful Place had not wholly engaged my Attention.

To the Charms of Wit, and the moſt polite Imagination ſhe joined an uncommon Strength of Judgment, and to the moſt refined Sentiments a learned Curioſity. Superior to the reſt of her Sex, without being ſolicitous to appear ſo, ſhe could talk of Ornament and Dreſs whenever there was Occaſion for it, and ask proper Queſtions upon more important Subjects. A natural Negligence, an eaſy Unaffectedneſs imbelliſhed all ſhe ſaid. She had Beauty enough to gain her Conſort many Friends, and was judicious enough not to ſhew any one a particular Regard, and theſe Accompliſhments being ſel-

dom

dom found united except in Books and the Imagination of Authors, is the Reaſon, I believe, that Learning in Ladies does not meet with ſo univerſal an Applauſe from the World as their Beauty.

When impertinent Viſitors gave us ſome Reſpite from Play, that Relief and Plague of Society, we paſſed ſome part of the Day in reading ancient and modern Authors contrary to the Opinion of that Monarch [a] who preferred old Books like old Friends. Our principal reading was Poetry, as this ſeemed of all others moſt agreeable to the Country from whence the *Genealogiſts* of polite Literature tell us it derived its Original. But, however, that we might preſerve a certain Spirit of Liberty, upon which all our Converſation was grounded, we did not entirely exclude that Sort of Poetry which is formed expreſly for the Town, as Satire,

[a] *Alphonſus* the 10th King of *Arragon*, ſirnamed the Wiſe, who uſed to ſay, he deſired little more than four *old* Things, *viz.* *old* Wood to burn, *old* Wine to drink, *old* Books to read, and *old* Friends to live with. He began his Reign in 1252, and died in 1284.

Comedy, and Epic. This Spirit had a more particular Influence upon our Criticiſm, which regarded an *Italian*, a *French*, an ancient and a modern Author, with an equal Impartiality. The ſober Dignity and Purity of the *Eneid*, the Variety and Perſpicuity of *Orlando Furioſo*, the noble finiſhing of the *Gieruſalemme Liberata*, the Juſtneſs, the philoſophical Spirit, and the peculiar Beauties of the *Henriade*, the Invention of the *Mandragora* [a], the Characters of the *Miſanthrope*, the Sweetneſs of Verſe in [b] *Sannazarius*, and the happy

[a] *Mandragora* or *Mandragola*, an *Italian* Comedy written by the famous *Nicolas Machiavel*.

[b] *Actius Sincerus Sannazarius* was born at *Naples* of a noble Family in 1488. He was Secretary to *Ferdinand* King of *Naples*, who honoured him with a great Share of his Confidence and Eſteem. He was eminent for his *Italian* and *Latin* Verſes. He ſpent twenty Years in correcting and poliſhing his Poem *De Partu Virginis*; but his piſcatory Eclogues in *Latin* which he wrote when he was young, were preferred to all his other poetical Writings. He was rewarded by the *Venetians* with a Preſent of 600 Crowns for his celebrated Epigram,

Viderat Hadriacis Venetam, &c.

He

happy Negligence of *Chappelle*; all theſe we compared in ſuch a Manner, that we neither eſteemed a Verſe the more harmonious for its Antiquity, nor a Thought leſs ſublime or elegant from any Difference of Country. We interſperſed our Diſcourſe with Epiſodes and Digreſſions, which the Marchioneſs did not think herſelf leſs obliged to me for, than if I had given her an Encomium upon her Beauty.

In one of theſe Digreſſions I ſpoke of the Force and Advantages of *Engliſh* Poetry, which gave her a ſtrong Inclination to be acquainted with it, imagining that a Nation, on whom *Minerva* had laviſhed her Favours in ſo profuſe a Manner, could not be deſtitute of thoſe of *Apollo*.

As I deſired nothing more than to give Pleaſure to a Perſon who continually afforded ſo much to me, I was

He died in 1530 of Grief, becauſe the Prince of *Orange*, who was General of the Imperial Army, had demoliſhed a Tower belonging to his Country-houſe. He lies interred near *Virgil*'s Tomb. See *Paulus Jovius in Elogiis*, &c.

extremely ſorry that I could trace her only a very low and imperfect Idea of *Dryden*'s harmonious Copiouſneſs, *Waller*'s Softneſs, *Prior*'s various and eaſy Style, the lively Wit and Fire of *Rocheſter* and *Dorſet*, the correct Majeſty of *Addiſon*, the ſtrong and manly Strokes of *Shakeſpeare*, and the aſtoniſhing Sublimity of *Milton*. To ſpeak of the Merit of a Poet, is the ſame Thing as endeavouring to deſcribe the Beauty of a Face, which can be judged of only by the Sight; and to quote, even in its original Language, only one particular Paſſage ſeparate from the reſt, would be the ſame as ſhewing an Eye, a Lip, or a Dimple of a Face of which we deſire to ſee, not ſingle Features, but the whole, whoſe Beauty and Symmetry are the Reſult of innumerable Charms. However it gave me a little Conſolation when I remembred, that, among ſome Papers which I happened to bring with me into the Country, I had Mr. *Pope*'s Ode on St. *Cecilia*'s Day. None can be unacquainted with the Name of this great Author,

Author, without being at the ſame Time ignorant that there is any ſuch Thing as Poetry in the *Engliſh* Language. The next Morning I carried this fine Ode with me into a Grove dedicated to our poetical Converſation, and now become the *Parnaſſus* of all Nations. After having begged Pardon of the *Engliſh* Muſes, I tranſlated it as well as I could, and began to read. The Marchioneſs liſtened to me with an Attention that fine Ladies ſeldom give themſelves the Trouble of. When I came to this Paſſage ——

While in more lengthen'd Notes and ſlow [a]
The deep Majeſtic ſolemn Organs blow.

ſhe interrupted me, and could not enough admire the Propriety of theſe *Epithets*, which (added ſhe) deſcribe that Inſtrument in ſuch a Manner that I really hear it play. I cannot tell whether you hear it too, but I think I

[a] Mentre con tarde ed allungate Note
Il profundo, Solenne, e Maeſtoſo
Organo Soffia ——

may reaſonably conclude it from a certain Pleaſure you ſhewed, perhaps inſenſibly, in reading this Paſſage to me. You are ſo well acquainted, *Madam*, with the moſt ſecret Motions of my Heart, that it is impoſſible for you to be deceiv'd; and you commend a Thing that certainly renders the Imagery, which is the Support of Poetry, extremely lively and expreſſive. Theſe Sort of *Epithets* are the Strokes that give Life to the Picture. A *white* Hand, a *ſerene* Brow, and *bright* Eyes, are at beſt but the rough Draught of it.

Now we are ſpeaking of Epithets, is not *the ſevenfold Light*, which I read of ſome Time ago, (replied the Marchioneſs) in an Ode made in Honour of the philoſophical Lady [a] of *Bologna*, ſome *Chineſe* Hieroglyphic? at leaſt it is ſo to me and many others whom I have deſired to explain it. You mean, anſwered I,

[a] *Laura Maria Katherina Barſi*, a learned Lady in *Italy*, who in 1732, at 19 Years old, held a philoſophical Diſputation at *Bologna*, upon which ſhe was admitted to the Degree of Doctor in that Univerſity.

— *The* ſevenfold *Light*
Whence ev'ry pleaſing Charm of Colour ſprings,
And forms the gay variety of Things[a].

If you knew the Force of this Epithet, you would ſee a *Newtonian* Picture inſtead of a *Chineſe* Hieroglyphic, though perhaps a little too philoſophical for Poetry. What (anſwered ſhe, interrupting me with an Air of Surprize) you underſtand this Paſſage as well, as if it was the Production of an *Engliſh* Author. I am of Opinion, *Madam*, anſwered I, that the Verſes of an *Italian* who has the Honour to be a great Admirer of you, are infinitely preferable to thoſe of an unfortunate *Briton*, who has the Unhappineſs of being at ſo great a Diſtance from you. I underſtand you, continued ſhe, and I need not deſire a better Encomiaſt than you,

[a] O dell, aurata
Luce Settemplice
I varioardenti, e miſti almi Colori.

if it be true, that no one underſtands the Senſe of an Author ſo well as himſelf. Come then, ſince you are the Author of this Piece, deliver me from the Perplexity I am under about this *ſevenfold* Light, and the reſt of your *Newtonian* Picture, which gives me great Reaſon to believe, that in praiſing one Lady, you have uſed your utmoſt Endeavours that no other ſhould underſtand your Meaning. It is certainly that profound Reſpect that I have for you, *Madam*, (anſwered I) which has made you find me out. Afterwards reflecting that it was impoſſible to give her in few Words an Explication of Sir *Iſaac Newton*'s Opticks to which theſe Verſes allude, a Thing which ſhe had not the leaſt Idea of, had not we better follow the Example of the Theatre, *Madam* ſaid I, where the Play is generally at an End when the Perſons come to a Knowledge of one another? And beſides, we ſhould finiſh Mr. *Pope*'s Ode, which will certainly give you a far greater Pleaſure, than any Comment upon mine. No, no, ſaid

ſaid ſhe, we will finiſh that another Time, and for the preſent we will act contrary to the Theatre, but without forgetting the Cataſtrophe, or finding myſelf in as much Ignorance as ever.

Being willing to give her ſome Idea of the Syſtem to which theſe Verſes refer, and thinking that the Marchioneſs would for once be like other Ladies, who are often deſirous of ſeeming to underſtand what they are not ſuppoſed to have the leaſt Notion of, I told her, as briefly as I could, That according to Sir *Iſaac Newton*'s Opinion, or rather as the Thing really is, every Ray of Light is compoſed of an infinite Number of other Rays, ſome of which are red, ſome orange-colour, others green, ſome blue, ſome indigo, and others violet; and that from the Compoſition of theſe ſeven Colours in a direct Ray from the Sun, ariſes the white or rather golden Colour of Light: That if this direct Ray from the Sun is refracted by a certain Glaſs called a Priſm, theſe Rays, of which it is compoſed differing in Colour, differ alſo in Degrees of Refrangibility.

frangibility. ——I ſee (ſaid the Marchioneſs, interrupting me in a Manner very different from what I expected) that your Comment has more need of an Explanation than perhaps the Text itſelf. But this is my Fault in not being able to underſtand your *Refraction*, *different Degrees of Refrangibility*, and the like, which quite confound the Idea I had begun to form. But pray explain yourſelf in ſuch a Manner that I may not have any farther Reaſon to accuſe you with Obſcurity, nor my own Dulneſs with being the Cauſe of it.

You will not be ſatisfied, anſwered I, unleſs I make you a Comment at leaſt as long as that of the *Malmantile*, which, I obſerved to you the other Day, ſeemed to be dictated by the agreeable *Mathanaſius* [a] who was formerly the *Moliere* of

[a] Monſieur de St. *Hyacinthe*, under the fictitious Name of Dr. *Mathanaſius*, publiſhed a Piece intituled, *Chef d'Oeuvre d'un Inconnu avec des Remarques*, in order to ridicule the Impertinence of ſome Critics and Commentators. The *Malmantile* is an *Italian* Piece wrote after the manner of this Author.

the

the Commentators; at leaſt, ſaid ſhe, *Newton* will enter more properly here than *Micheli* does there, whoſe Diſcoveries are of no ſort of Service to illuſtrate this Poem; and ſince all you ſaid was ſpoke with an Air of Seriouſneſs and ſuch Confidence that you did not ſcruple ſaying, *according to Sir* Iſaac Newton's *Opinion, or rather as the Thing really is*, you have made me extremely deſirous of becoming a *Newtonian*. This, anſwered I, is a very ready Method of propagating Sir *Iſaac Newton*'s Philoſophy and bringing it into Faſhion. *Pemberton*, *Graveſand*, and *Dunch*, the zealous Propagators of this Syſtem, would be very glad to give the Care of it to you. But what will Mr. *Pope* ſay (ſhewing her the Book which I had ſtill in my Hand) if you leave him in the Beginning of this fine Ode, for a ſudden Fancy that you have taken to Light and Colours? Mr. *Pope*, anſwered ſhe, cannot be offended at my leaving him for a Philoſopher, and ſuch a Philoſopher as Sir *Iſaac Newton*, one of his own Countrymen too.

Do not you know, ſaid I ſmiling, that the Poets look upon themſelves as ſacred, and when they have once got this Enthuſiaſm into their Heads, they regard neither Country nor Relations, but think themſelves greater than any Philoſopher, even if he had diſcovered wherein conſiſts the Union of the Soul and Body? 'Tis well for us, ſaid ſhe, that the Poets have more Modeſty than to declare this in their Writings.

It ſignified nothing for me to plead Incapacity and many other Excuſes, which are made uſe of on the like Occaſions, and which occurred to me upon this. The Marchioneſs inſiſted upon ſeeing my *Newtonian* Picture as ſhe called it. I begged ſhe would at leaſt have Patience till Evening, telling her that the Night had always been the Time conſecrated to philoſophical Affairs; and that the moſt polite Philoſopher in *France* had made uſe of it in a Circumſtance reſembling mine, and made no Scruple of entertaining a fine Lady with philoſophical Diſcourſes in a Wood

at

at Mid-night. But we, Sir, replied the Marchioneſs, ought to make uſe of the Day, which is certainly more proper than the Night for a Diſcourſe on Light and Colours. She ſpoke this with an Air of Authority that inforced her Commands in the moſt amiable Manner, and made it a Pleaſure to obey.

Thus I was abſolutely obliged to begin, but the Difficulty was how to do it; for ſhe had not the leaſt Notion of Phyſics, which it was neceſſary to give her a general Idea of, before I proceeded to a Diſcourſe upon Light and the *Newtonian* Syſtem. At laſt, after having again in vain reminded her of Mr. *Pope* and other Subjects that required leſs Application and afforded greater Pleaſure, when the Heat of the Sun, which was now almoſt at his Meridian, obliged us to retire into the Houſe, I began after the following Manner.

It is natural to ſuppoſe that after Society was ſo well eſtabliſhed among Mankind, that ſome of them had nothing to do (which I look upon as the

Epocha

Epocha of its Perfection) theſe Perſons either from that Curioſity, which we naturally have about thoſe Things that concern us leaſt, or perhaps for fear of being charged with Idleneſs by the reſt, applied themſelves to conſider that Variety of Things of which this Univerſe is compoſed, their Differences and Effects. It is probable too, that one of the firſt Speculations that theſe idle People, who afterwards aſſumed the Name of *Philoſophers*, employed themſelves about, was concerning the Nature of Light, which is certainly the moſt beautiful and conſpicuous Object of our Sight, and indeed the Means by which we ſee every Thing elſe. This conſequently led them to the Colours which this Light depictures upon Objects, and which diffuſe ſuch a Variety and Beauty on our World. Thus, I believe, that *Opticks*, which is that Part of Natural Philoſophy that regards Light and Colours, and in general all Natural Philoſophy, had their Origin among Men at the ſame Time with their Idleneſs; indeed it was of a later Date than ſome

Parts

Parts of Morality and Geometry, which were abſolutely neceſſary in the earlieſt Ages of the World, but contemporary to Poetry, if you will, and antecedent to Metaphyſics, which required a ſtill greater Vacation from Buſineſs.

I am pleaſed, replied the Marchioneſs, that Poetry and Natural Philoſophy have one common Date; ſince for that Reaſon you will not perhaps think this Tranſition ſo ſtrange, that we have made from one to t'other upon my Account. The Tranſition, (anſwered I) that our Philoſophers made from a ſlight Knowledge of Things to an Ambition of unfolding Nature and penetrating its Effects, was much ſtranger. This, in the Language of Philoſophy, is called making *Syſtems*. This is juſt as if any one, after having had a curſory Diſcourſe with a ſubtile Miniſter of State about good or bad Weather, ſhould attempt to write his Character, and pretend that he had penetrated his moſt profound Secrets. They ſhould have begun with a very attentive Examination of Things, drawn from frequent Obſervations and diligent

diligent Experiments before they ventured upon the leaſt Syſtem. They were to act, if poſſible, like thoſe two antient Philoſophers; one [a] of whom, in order to write on the Nature of Bees, retired into a Wood, that he might have the better Opportunity of conſidering them; and the other [b] ſpent ſixty Years in making Obſervations upon theſe Inſects. But the Misfortune is, that Experiments and Obſervation require Patience and Time, and very often we are indebted to mere Chance for the moſt uſeful and entertaining among them. On the other Hand, Men are always in haſte to arrive at Knowledge, or at leaſt to have the Appearance of it.

After this, the Revolutions of States, the rude and uncultivated Manners of the People, the Temper of Nations, and the Profeſſion of thoſe, among whom Philoſophy had formerly flouriſhed, did not a little retard its Progreſs. From the *Indian* Traditions

[a] *Philiſcus, vid.* Plin. *N. H. L.* xi. *C.* 9.
[b] Ariſtomachus. *Id. ibid.*

which

which their Prieſts kept to themſelves with as much Jealouſy as they did their Genealogies, and from the *Egyptian* Temples, where it had long lain hid under Myſteries and Hieroglyphics, Philoſophy at Length took its Seat in the Portico's and Gardens of *Greece*, where it was very ſoon imbelliſhed and corrupted with Allegory, Fables, and all the Ornaments of Eloquence. Imagination, which is the Characteriſtic of the *Grecian* Genius, prevented Philoſophy from taking any deep Root, and indeed it was attempted to have been totally extirpated by the Eloquence of a Man whoſe Diſcourſes were diſtinguiſhed by a certain grave and elegant Pleaſantry, which made him Maſter of the moſt powerful Arts of Perſuaſion, and who had been judged by the Oracle the wiſeſt among Mortals. He aſſerted, that we have nothing to do with what is above us, and ſtrove to reclaim our Curioſity and Studies from natural to moral Objects; from the Combinations of the Univerſe, to the little Chaos of human Extravagancies,

and from that Rapture with which we are tranſported by the Contemplation of vaſt and diſtant Objects, to the melancholy Conſideration of our own Emptineſs. And this Perſon, who, more deſtructive than *Pandora*, engaged Mankind in a Conſideration of that Train of Evils which had iſſued from her fatal Box, without giving them [a] any Hopes of a Cure, was had in the higheſt Veneration as the Father of a new Philoſophy called *Moral*, which is of all others the moſt treated of and the leaſt underſtood.

Philoſophy after this, together with Luxury, Riches, and Corruption, was tranſported from *Aſia* to *Rome*. It could make but little Progreſs among a People who cultivated hardly any other Art but thoſe of pardoning the vanquiſhed, and depreſſing the proud. In the firſt Ages of Chriſtianity, Philoſophy lent its Aſſiſtance to combat *Pa-*

[a] It is probable that the greater Part of thoſe, who are acquainted with the Character of *Socrates*, will think Signor *Algarotti* has paſſed too ſevere a Cenſure

ganiſm,

ganiſm, and after this was ſubdued, it raiſed ſo many civil Wars and Diſſentions among thoſe who by its Aſſiſtance had triumphed over *Jupiter* and *Olympus*, that the eccleſiaſtical Ship ſeemed in Danger of periſhing when it was hardly looſed from the Port. To this fatal War of Words ſucceeded that which the *Barbarians* raiſed againſt Learning and the Roman Empire, wherein both were equal Sufferers; for it deſtroyed the one, and ſunk the other. 'till from the profound Darkneſs, which afterwards followed, ſome Sparks of antient Knowledge were re-kindled among the *Arabians*. The Doctrine of *Ariſtotle* revived, and being ſpread through the *Eaſt*, was gladly embraced by the Monks, as it was the moſt ſuitable to their Manner of Life. How much Pains and Study are neceſſary to frame a right Philoſophy! It requires no leſs Art and Labour, than to make thoſe fine Silks which you Ladies are adorned with. But the Philoſophy, in which the Name of *Ariſtotle* ſupplied the

the Place of Reaſon, did not greatly diſturb the Monaſtic Tranquillity. This Philoſopher who was baniſhed [a] from *Athens* by the antient Prieſts, was (but with ſome Variety of Fortune) received by ours; who, though

[a] *Ariſtotle* retired from *Athens*, in order to avoid a Proceſs of Irreligion which the *Athenian* Prieſts carried on againſt him. The Circumſtances of this Affair are unknown: Some aſſert, that he was charged with Impiety on Account of a Hymn which he had made in Honour of his Friend *Hermius*. This Hymn is ſtill extant, but there is not the leaſt Impiety diſcoverable in it; but his Accuſers urged that he had prophaned divine Songs by proſtituting them to the Honour of a mortal Man. *Ariſtotle* not thinking it ſafe to truſt to the Interpretation this little Poem might meet with, retired very privately to *Chalcis*, where he pleaded his Cauſe at a diſtance by Writing, which was the ſafeſt Way he could take; for his Accuſers were a Set of Men who would never have let him been at reſt. Others affirm that he was driven from *Athens* for the Goodneſs of his Morals. Some Authors report, that this Philoſopher drowned himſelf in the *Euripus*, a narrow Sea near *Eubœa*, becauſe he could not find out the Reaſon of its ebbing and flowing ſeven Times in one Day. But the more received Opinion is, that his very great Application in the Study of this Phænomenon, brought an Illneſs upon him, which occaſioned his Death. *See* Bayle's *Life of* Ariſtotle *in the* General Dictionary, Vol. II.

they

they once condemned him as a [a] pernicious Author, yet afterwards carried their Zeal for him to ſuch a Height, as to believe him not ignorant even of thoſe Things which are above the Reach of human Reaſon. Religion at this Time was more than ever united with

[a] The *French*, who took *Conſtantinople* about the Beginning of the 13th Century, having brought the Books of *Ariſtotle* into their own Country, his Doctrine began to be publickly taught in the Univerſity of *Paris*, and continued ſo for ſome Time. But *Amaury*, a Student in that Univerſity, having advanced ſeveral obnoxious Opinions, and endeavoured to defend them from the Principles of *Ariſtotle*, the Phyſics and Metaphyſics of that Philoſopher were burnt by order of a Council held at *Paris* in 1209. and the reading of them prohibited under Pain of Excommunication. This Prohibition was confirmed about the Year 1215, by the Pope's Legate, who was employed to reform the Univerſity of *Paris*; but he allowed the Logic of *Ariſtotle* to be taught. *Gregory* VII. renewed this Prohibition in 1231, but with this Addition, that he only forbid the reading of *Ariſtotle*'s Works till they ſhould be corrected. In 1261, *Simon* the Legate of the See of *Rome* in his Reformation of the Univerſity confirmed the Regulation of the Year 1215, relating to *Ariſtotle*'s writings without mentioning the Correction of them. But in the Reformation of the Univerſity in 1366, this Philoſopher's Phyſics, as well as his other Works, were allowed to be read. *Vid. Father* Rapin's *Compariſon of Plato and* Ariſtotle, Du Pin's *Nouvelle Bib.* &c.

Philoſophy, which could not fail to produce the utmoſt Confuſion in the one, and Ignorance in the other, ſince both their Nature and End are extremely different.

A Chaos of vain and uſeleſs Diſputes, a Chain of unintelligible Definitions, a blind Zeal for wrangling, and a ſtill blinder Devotion for *Ariſtotle* whom they called by Way of Diſtinction, *the Philoſopher*, or a ſecond Nature, and above all a certain Jargon of indeterminate, obſcure, and hard Expreſſions, either without any Meaning, or confuſed, ſpread like a deſtroying Deluge the Face of the whole Earth, and for many Ages uſurp'd the pompous Name of Science. As among the *Chineſe* he is eſteemed the moſt learned who can read and write more Words or Figures than the reſt, ſo he was counted to have moſt Learning among us, who in a particular Habit, could pronounce in certain Places, and with certain Geſtures, and ſeemed to underſtand the greater Number of Expreſſions in this vain and

and pedantic Jargon. Their Diſtinc-tions and Anſwers might be as eaſily foreſeen by any one who had a little examined their Memoirs, as the Turns of Muſic in Country Scrapers, or the Jingling of Rhyme in bad Poets. Such were the Vails under which they hid, from the Eyes of the World, that Ignorance which very often they could not hide from themſelves. The Pride of Schools was ſupported by the Noiſe of empty Words, and the Tyranny of Names. It was imagined that they really contended for Truth, but theſe gray-headed Children in Reality amuſed themſelves only in fighting with Bub-bles.

This obſtinate Veneration for the Antients, which for a long while paſ-ſed among the Philoſophers as heredi-tary from one Generation to another, was the Cauſe that the Knowledge of Phyſics made little or no Progreſs till the laſt Age. At length among ſome few others, who were to fall as it were Martyrs to Reaſon, there appeared in

Tuſcany a Perſon named [a] *Galileo*, who had the Courage not only to ſay, but what is worſe, to demonſtrate with the cleareſt Evidence, that Men, who had perhaps for ſixty Years been honoured with the Title of Doctors, or ſat in the Chair of Philoſophy, had taken very great Pains all their Life long to know nothing. And this Boldneſs coſt him

[a] *Galileo* was born at *Florence* in 1564. He was put into the Inquiſition for maintaining the Diurnal Motion of the Earth, and aſſerting the Sun and not the Earth to be the Center of the World. Theſe Propoſitions were condemned by the Inquiſitors as falſe and heretical. He was not diſcharged till he had promiſed to renounce his Opinions, and not to defend them either by Word or Writing, or inſinuate them into the Mind of any Perſon. Upon his publiſhing his Dialogues upon the two chief Syſtems of the World, the *Copernican* and *Ptolemaic* in 1632, he was again cited before the Holy Office. The ſame Year the Congregation convened, and in his Preſence pronounced Sentence againſt him and his Book, committing him to the Priſon of the Holy Office during Pleaſure, and commanding him as a ſaving Penance for three Years to come to repeat once a Week the ſeven Penitential Pſalms, but reſerving to themſelves the Power of moderating, changing, and taking away, altogether or in Part, the above mentioned Puniſhment and Penance. He was diſcharged from his Confinement in 1634, but the Impreſſion of his Dialogues *of the Syſtem of the World* was burnt at *Rome*. *Vid. The* General Dictionary.

dear;

dear; for to venture to make uſe of his Reaſon was the ſame Thing as reproaching them with the general Abuſe they had made of theirs; and to endeavour at the Promotion of Knowledge was as dangerous as an Attempt to change the Boundaries of antient *Rome*, which the *Augurs* took ſuch a religious Care in the Preſervation of. After ſuch a Courſe of Ages, he ſhewed them what ought to have been done at firſt, and began to make a Search into Nature by Obſervations and Experiments, reducing himſelf to that Ignorance which is uſeful for arriving to ſome Knowledge at laſt.

I think it not improper to call this Man the Czar, *Peter the Great*, in Natural Philoſophy; each of them had to do with a Nation of pretty near the ſame Character. No one People ever uſed ſuch Endeavours for Knowledge, as the *Muſcovites* did to know nothing. They forbid all Strangers to come into their Country, and all the Natives to go out of it, for fear they ſhould introduce ſomething new. Thus was it

with theſe Philoſophers, who, jealous of their Tenets, renounced every Experiment, and more certain Demonſtration of the Moderns, rather than introduce any Novelty or Reformation into their own Syſtems; but as Force has generally more Influence upon Men than Reaſon, the Czar compaſſed his Deſigns ſooner than *Galileo*, who was at the ſame Time obſtructed by another Species of Philoſophers, who were by ſo much the more formidable as they too deſpiſed the Antients, (which now began to be the Faſhion) and aſſerted Things in Oppoſition to them of which every one had a clear and diſtinct Idea. They introduced Exactneſs and Order into Writing, which were then as uncommon as they are natural and neceſſary, and by Means alone of certain Motions and Figures, which they knew how to give to Bodies at proper Times and on proper Occaſions, promiſed to unfold what ſeemed the moſt unexplicable in Nature. You may eaſily imagine that the magnificent Promiſes of theſe Philoſophers, which ſo agreeably

agreeably flattered the Ambition of the human Mind (which *Galileo*'s Obſervations ſerved rather to humble) joined to a certain Simplicity that gave ſuch an Air of Wonder to their Syſtems, as it does to a well concerted Romance, muſt naturally ſeduce many People, and form a Sect. And it indeed had this Effect; ſo that theſe Moderns too began to have Expoſitors, and Followers as obſtinate and zealous as thoſe of the Antients had been before; and theſe made themſelves the more ridiculous by laughing at the ſame Fault in others. But it was a melancholy Thing to ſee an Experiment ſometimes offer itſelf, which had never before been known or thought on; and the fineſt and moſt artificial Syſtems, which had perhaps coſt their Inventors whole Months of Labour and Study, ſhamefully fall to the Ground.

In order then to avoid theſe ſorrowful Reflexions, ſaid the Marchioneſs, it is neceſſary for thoſe, who would form a Syſtem in any Thing, to be careful firſt to take Notice of all that is obſervable in it,

that it may not be expoſed to the Mercy and Inſults of Experiments. This is exactly what the *Newtonians* ſay, anſwered I, and certainly, *Madam*, you muſt have ſome ſecret Intelligence with them to be ſo well informed of their Sentiments. It would be ridiculous for a Mechanic to take it in his Head, to gueſs how the famous Clock of *Strasbourg* is made within Side, if he had not firſt acquainted himſelf with its outſide, the manner in which it ſtrikes, and thoſe many other Things it does beſides telling the Hour. Thus, ſay they, if we can ever hope to make Syſtems that carry ſome Appearance of being durable, it will be then only when by the Means of Experiments and Obſervations we ſhall know all, that in Terms of Art is called *Phænomenon*, which ſignifies the Appearance of Things, and the Laws which reſult from theſe *Phænomena*, and by which Nature conſtantly performs all her Operations. How then could *Des Cartes* for Example, who was the chief Author of this enterpriſing Sect of Philoſophers, make a rational

tional Syſtem concerning *Light* and *Colours*, when he was entirely ignorant of ſo many of their Qualities, which Sir *Iſaac Newton* afterwards diſcovered by Obſervations? How could he form the Statue, when he had not the Marble? This is the manner in which the reſt of the Philoſophers of our Time, and thoſe learned Societies founded and maintained by the Liberality of Princes, or the Genius of Nations, proceed; they make Obſervations and prepare Materials for Poſterity to build Syſtems upon, more fortunate in their Duration, than thoſe that preceded the preſent Age. This Profeſſion indeed is not ſo pompous as that of thoſe who will build you a World in the twinkling of an Eye; but on the other Hand it has this Advantage, that it is able to make good its Promiſes, which is as great an Obligation upon a Philoſopher, as a Miſtreſs.

I, who am a Woman, replied the Marchioneſs, confeſs that I love thoſe who have the Courage to venture upon grand and difficult Enterpriſes. Is

not this the Reaſon why we intereſt ourſelves ſo much in the Adventures of Heroes? The Courage of thoſe philoſophical Heroes has ſomething ſublime and ſuperior in it: If they do not attain to all they promiſe, muſt there not be given ſome Indulgence to the Imperfections of Human Nature? On the other hand, if, as you ſay, there cannot be any good Syſtems, till all the Phænomena are fully known, when ſhall we have them? They will happen as ſeldom with us, as the ſecular Games anciently among the *Romans*: And I cannot flatter myſelf that I ſhall live long enough to ſee ſo much as one in my time. I muſt be contented then with thoſe Syſtems that we have, be they what they will. I believe, Madam, anſwered I, that no one could have more ſpecious Reaſons to alledge in favour of Trifles, I ſhould ſerve you right, if I put you on proving theſe Reaſons; but as I will act more mercifully with you, than you perhaps would with regard to me, (ſince you have a mind that we ſhould reaſon away that

Time, which might be better employ'd on Pleaſure) I will not make uſe of that Right which theſe Reaſons of yours give me, to propoſe to you ſeriouſly the important Queſtions, Whether Light be a Subſtance, or an Accident, or an Act of the Pellucid, as far as it is pellucid? Whether Colours are the firſt Configurations of Matter, or a certain little Flame that ariſes from Bodies, whoſe Parts are proportioned to our Sight? I might gravely aſk you too (that you may ſee how many things I ſpare you the Trouble of conſidering at once) Whether Light, or its Spirit, be the Soul that *Plato* places between Nature and Ideas, to connect the ſenſible and intellectual World? and Whether it was for this Reaſon that *Plato* repreſented the Element of Fire, which is the Seat of Light, under the Figure of a Pyramid, which in ſome meaſure agrees with that ſublime and myſtic Triangle which is the Symbol of this Soul? idle Enigmas of the learned Ignorance of paſt Ages! And who can tell but if you had fallen into o-

ther hands than mine, you might have been ſet a yawning with ſome *Gothic* Paſſages out of *Dante*? Or perhaps by this Light, you would have been gradually conducted to Divinity; at leaſt you could not have got free from an Explication of the myſtic Senſe hid under the Fable of *Prometheus*, who ſtole Light from the Sun to animate his Statue.

I ſee, ſaid the Marchioneſs, that Philoſophers are to be dealt with in a very circumſpect manner, who know how to improve every thing to their own Advantage. You act juſt like Tyrants, who think they confer a great Favour on any one, whom they have not injured. However, I am much obliged to you, for ſparing me the Trouble of hearing all theſe fine Things, which, I confeſs, are quite above my Underſtanding.

Let us ſee, anſwered I, whether you can underſtand the Doctrines of ſome among the Ancients who were more prudent and humane than the reſt. Theſe labour'd to explain every thing by a Vacuum,

and the Motion and Figure of certain very little Particles, which they called Atoms, and from thence gave their Schools the Name of *Atomiſts*, which was perhaps the moſt antient of all other Sects, and lately try'd by the Splendor of Eloquence to riſe upon the Ruines of the *Ariſtotelian*, in oppoſition to that of *Deſcartes*. Theſe Philoſophers aſſerted that the Light of the Sun, for Example, was nothing but a perpetual and copious Stream of the very little Particles, or Atoms, which flowing from the Sun himſelf, ſpread themſelves every way with an incredible Velocity, and fill the immenſe aerial Space; ſo that Light is always followed by new Light, and one Ray is as it were impelled by a ſecond. You may eaſily underſtand this by the Similitude of a Fountain. —— I underſtand it mighty well, interrupted the Marchioneſs, without the Fountain; but I am greatly afraid that theſe Atomiſts of yours, by making ſo many Particles continually proceed from the Sun, will at laſt turn ſome fine Day into

into Midnight. Truly, anſwered I, that would be playing us a villainous Trick, which no one would get any thing by, unleſs perhaps ſome few Beauties, who would then always be ſeen by Candle-light: But do not fear it, Revolutions of this Importance require more time to be brought about, than the Revolution of a Monarchy. And beſides theſe Atomiſts give us ſo great a Security that it would be a Shame to dread it. For, in the firſt place, they tell us, that the Rarity and incredible Smalneſs of theſe little Particles that proceed from the Sun (which Sun they make to be of a denſe and cloſe Matter as you will ſee hereafter) in a very long courſe of Years will produce only a very little Diminution in his Light. And to make you ſtill more ſecure, this may be confirmed by the Example of a little Grain of Colour, which is ſufficient to tinge a very great Quantity of Water. An Example drawn from odorous Bodies, may ſerve to ſhew you how very much the Parts of Matter may be ſubtiliſed; as, for inſtance,

inſtance, a Grain of Muſk, which, though it continually emits a prodigious Quantity of Particles yielding a Perfume ſo ſtrong and quick that at a certain Diſtance it is able to ſtupify Serpents of a monſtrous Size, and quite deprive them of Motion, yet in a conſiderable time its Weight is but very little diminiſhed. And Amber-greaſe, in the ſame manner, for a long while loſes hardly any thing of its agreeable Scent. From Light's paſſing thro' the denſeſt Bodies, ſuch as Diamonds and Gold when it is beaten into thin Plates, we muſt neceſſarily infer, that the Particles of Light are extremely ſubtile. All this is mighty well, replied the Marchioneſs; but that ſuch a Quantity of Light ſhould continually proceed from the Sun, as is ſufficient to fill and illuminate this whole World, puts me into terrible Apprehenſions, notwithſtanding all your fine Examples of Muſk, Amber-greaſe, and Diamonds.

Have not you ſome Inclination, anſwered I, to the learned Melancholy of the Inhabitants of *Dean Swift*'s flying

flying Iſland? Who in the moſt Poetical Allegories has given us the moſt philoſophical Satyr upon Mankind. This Iſland, which, in the Language of the Country, is called *Laputa*, as it is different from all that have hitherto been diſcovered by our Voyagers, ſo it is inhabited by a very ſingular Species of Men: Always abſtracted and immerſed in the profoundeſt Speculations, they give themſelves up to Spleen and the Mathematics, ſo that they have always need of a *Flapper*, who, by ſtriking them from time to time with a Bladder, may bring them back to the World below, their Knowledge fills them with thoſe continual Fears and Diſquietudes which the Vulgar by a happy Privilege of their Ignorance are quite free from. They are afraid that a Comet, by approaching a little too near the Earth, may in an inſtant reduce us to Aſhes; or, that the Sun one Day or other will ſwallow us up; or, that this immenſe Source of Light and Heat will at length be exhauſted and leave us involved in a profound and eternal Night.

Night. May not your Fears, Madam, be ſaid a little to reſemble thoſe of the *Laputian* School?

As to the *Flapper*, anſwered ſhe, I have nothing to do with that, eſpecially when I am with you. But do you not think that there is ſome Reaſon for me to be frighted at the terrible Threatning of a perpetual Night? Ought you not rather to think yourſelf obliged to me for intereſting myſelf ſo much in the Cauſe of *Light*, which you have made your Heroine? It would be quite ſhameful that I ſhould ſhew more Regard and Concern for it, than yourſelf. You ſhall ſee, *Madam*, anſwered I, that theſe Atomiſts have taken Care to ſecure your Repoſe, and preſerve what you ſhew ſuch a Regard for. They will find you a Method to recruit the Sun with that Facility which a Philoſopher is Maſter of, who knows how to make all Nature ſubſervient to his Schemes. They will make the Seeds of Light and Heat which are diffuſed through the Univerſe, continually return back again into the Sun, in order to repair his

his Loſſes. They will place ſomething round him with which he is ſuſtained and reſtored juſt as a Lamp is fed by Oil or ſome other Matter. We will call certain Syſtems to our Aſſiſtance which will lend us Comets that from Time to Time ſhall fall into the Sun and afford him freſh Supplies: And if this be not ſufficient, we will have Recourſe to ſome Philoſopher, who may find Means to make a Star fall into him. And if you have not Confidence enough in human Syſtems, we will call a Celeſtial one to your Aid, revealed to *Adam* by an Angel in *Milton*, who aſſures us, that the Sun draws his Aliment from humid Exhalations, and in a regular Manner takes his Supper every Night with the Ocean. Will you have any more? No, no, ſaid ſhe, the one half of theſe Things is ſufficient to diſſipate the Fears of a *Laputian* himſelf. And I hope there will be no need at preſent to trouble any Philoſopher, much leſs a ſuperior Being.

I wiſh

I wiſh, anſwered I, that your Fears may never extend to any thing farther than Philoſophy, and that your Beauty, as it has many other Qualities in common with the Sun, may have a common Duration with him. But I am extremely glad that ſince I have delivered you an Opinion which at firſt Sight gave Occaſion to your Fear, it is capable too of diſſipating that Fear: As you are ſo very ſubject to be frighted at every Trifle, I do not know what would have happened, if I had told you the Opinion of a famous Antient who affirmed the Sun to be a Mirror formed of a Subſtance reſembling the moſt poliſhed Cryſtal that ſends and reflects the Light to us, which is tranſmitted to all Parts of the Univerſe, and there unites. What Hopes ſhould we have of finding proper Materials above, to repoliſh this Mirror, if it ſhould ever happen to be ſullied and grow dim? Let him, replied the Marchioneſs, who made the Sun a Mirror, contrive how to repoliſh it when

when it ſhall want it, I had rather imagine it to be the Soul of the World, and to be itſelf the Source of Light. You ſhould have added, that it is the Source of Colours too (anſwered I) ſince without Light theſe entirely vaniſh and are no more. Say rather, replied the Marchioneſs, that they are no longer viſible. Will you tell me that an Hour after Sun ſet, there are no Colours in this Picture? I ſhould be glad to hear you prove to me that the Picture too is vaniſhed for the ſame Reaſon, becauſe it is no longer viſible. The Picture, anſwered I, and the Canvas ſtill remain, and upon it certain Diſpoſitions in the Figure and Texture of thoſe Atoms, of which the Chalks that are made uſe of in the Painting are compoſed. And theſe Diſpoſitions, at the Approach of Light, will again make the Colours Mezzotintos and Chiaro Oſcuros, appear upon the Canvas, and reſtore to your Sight a commanding Beauty, a Flight of Pillars, a verdant Meadow, or the opening Bluſhes of the Morning. In the Dark all theſe Objects vaniſh,

niſh, as they are the Reſult of a Combination of thoſe Diſpoſitions and Light together. I might allege the Authority of *Virgil* upon this Occaſion, who informs us, that Objects loſe their Colours at the Approach of Night. *Lucretius*[a], who, in the moſt elegant Verſes has given us a Body of this Atomic Philoſophy, makes us apprehend moſt terrible Conſequences from a Suppoſition that Bodies and their Principles are indued with Colour. For, ſays he,

Seeds are Colourleſs without a Dye.
For either this cannot to Seeds agree;
Or Seeds are not immortal all and free
From Change, and therefore things may
fall to Nought. CREECH.

You give me Conſequences and Verſes, ſaid the Marchioneſs, when I want Evidence and Explications. *Deſcartes*, anſwered I, will afford you enough of this, who has diſcuſſed this Matter much more fully than *Lucretius*. His Principles are different, but in this Point he

[a] Proinde Colore cave, &c. *Lucret.*

agrees

agrees with the Atomiſts. But you want Syſtems, and I muſt ſatisfy you: You ſhall ſee the moſt daring Products of Imagination, which have for ſome time deceived thoſe, who aſſumed the pompous Title of Searchers after Truth. The Illuſion is at length vaniſhed, and Philoſophers are grown more cautious and difficult, and examine one another with more Violence than the *Egyptians* did their Dead before they would allow them the Honour of Sepulture. Come, ſaid the Marchioneſs, explain me this Syſtem of *Deſcartes*. I ſhall not be ſo difficult as not to receive Pleaſure from it, even if it be ſuch a one as you make me expect. It is Pity, *Madam*, anſwered I, but that every Thing ſhould from this Time be propoſed to you under the Form of a philoſophical Syſtem.

Suppoſe to yourſelf, that all the Matter, of which this whole World is compoſed, was from the Beginning divided into exceeding ſmall and equal Particles, of a Figure nearly reſembling a Dye. Suppoſe too, that ſome of theſe Particles

cles turn round one Point, and ſome another, and that at the ſame Time they all turn round themſelves like a Wheel, which, while it is moving to any particular Spot, makes many Revolutions about its ſelf. The Points about which theſe Particles turn are the Stars, the moſt luminous and ſhining Points in the Univerſe, and which will help you to conceive it full of *Vortices*, for this is the Name that is given to any Maſs of Matter that is whirled round a Point or common Centre, juſt like the Circles of Water in a River, or the Duſt that flies when it is agitated by the Wind. I believe you will not ſcruple to grant the Sun a *Vortex* of his own upon my Aſſertion, ſince he is not at all inferior to any of the Stars. If you deſire it, anſwered the Marchioneſs, I will go farther, and allow him the largeſt and moſt magnificent *Vortex* in the World. For I think he highly deſerves it, to whom we have ſo many Obligations. Philoſophy, anſwered I, is leſs intereſted, and has no more Partiality for the Sun, than for the leaſt

Star

Star in the milky Way. It is ſufficient if you grant the Sun a *Vortex*, be it what it will. From this *Vortex* you ſhall ſee the Sun himſelf ariſe (for hitherto I have ſuppoſed him and the Stars to exiſt, the better to aſſiſt your Imagination) and with the Sun, all the Charms of *Light* and *Colour*, and I know not what beſides. In ſhort it is like an inchanted Palace, where you have only need to ask for what you want, and it will appear in an Inſtant.

What I have granted you is ſo little, replied the Marchioneſs, that I cannot flatter myſelf with the Hopes of ſo great a Happineſs as you promiſe me. The Mathematicians, anſwered I, are ſaid to reſemble Lovers. If what you grant them at firſt be ever ſo little, they know how to make ſo good an Advantage of it, as to lead you inſenſibly farther than you ever imagined. Now you are to conſider that this Philoſopher, to whom you have granted what you think ſo ſlight a Conceſſion, was a very great Mathematician. I have as little Skill in the Artifices of Love,

ſaid

ſaid the Marchioneſs, as in thoſe of Philoſophy and Mathematics. But it is inconceivable to me that any Thing reaſonable can be produced by theſe *Vortices*, which after all are nothing but Collections of extremely ſmall Particles, that keep whirling round a Point at the ſame Time that each of them turns round itſelf. They may whirl on for ever, and I believe that will be the chief of their Buſineſs; who would ever have imagined, anſwered I, that the accidental Meeting of a Hero and Heroine in a Romance, and a certain *Je ne ſçai quoi*, that he diſcovers in her, could have ſupplied Matter for twenty Volumes? And yet there are many Inſtances of this, (Perhaps too many) in a Nation very near our own. And without giving the Heroes any Trouble in this Affair; what an infinite Number of Things might there be produced from that *Je ne ſçai quoi*, that every one ſees in you? —— Let us ſee at preſent, ſaid the Marchioneſs, what *Des Cartes's Vortices* will produce; for

after theſe twenty Volumes, I ſhall begin to think every Thing poſſible.

Theſe Particles then (continued I) in the Figure of a Dye, (which you now begin to have a better Opinion of) whirling in this Manner round themſelves, muſt make terrible Colliſions, and conſequently, break the Angles or Points of each; which deprive them of a Power of turning freely round themſelves. You know, *Madam*, that, if any Thing be taken away from the Corners of a Dye, it will grow round, and in Proportion as the Angles of what remains of the Dye keep ſucceſſively diminiſhing, it will gradually approach ſtill nearer to the Shape of a Ball. And this you are to believe was the Caſe with theſe Particles, which by continually ſtriking againſt one another, were at length changed from their firſt Figure of a Dye, to that of ſo many little Balls or Globules. The Matter which aroſe from the Shavings of theſe Angles, and which by its continual Colliſion muſt neceſſarily be reduced into very ſmall and volatile Particles, did not remain

remain idle, but had its proper Office. It immediately declared open War against the Vacuum of the Atomists, and threatned to destroy and banish it from the Universe, wherever it was to be found. The first Undertaking of this Matter, was to fill up those little Voids which otherwise would have remained between the Globules; for though they touched one another, yet there must have been some empty Spaces between them arising from the Nature of a globular Figure. But without the Assistance of this *Matter*, there would have remain'd a much more considerable Void in the Centre of the *Vortex*. The Globules were reduced to a much smaller Size than they were at first; and were proportionably removed from the Centre, by a Law common to all Bodies moving in a Circle; which recede as far as they possibly can from that Point about which they Turn. This Matter then run into the midst of the *Vortex* in order to fill the Centre of it, and began itself to turn round together with the Globules, and animate the

reſt of the *Vortex*. This ſubtile and volatile Subſtance, which is called the *Matter of the firſt Element*, or the *ſubtile Matter*, forms nothing leſs than the Sun and Stars in the Center of the *Vortices*; as the Globules that turn round them, and which are called *the Matter of the ſecond Element*, furniſh Matter for the Heavens; and though the CARTESIANS have deprived it of that Tranſparency and Adamantine Solidity that formerly rendered it ſo venerable among the Antients, they have taken Care however to atone for this Injury, by making it the Original of Light, and by this Means it has gained more than it loſt.

What, cried the Marchioneſs, are we got already to the Origin of Light? Your Heroes and their twenty Volumes have made a very bad Uſe of their Time, compared with us. If you give a farther Attention, anſwered I, you will find they have made a much worſe uſe of it even than you believe. The Syſtem of *Des Cartes* preſents you a Scene, ſuch as, I believe, you never beheld in the fineſt

and

and moſt ſplendid Opera. The whole Extent of the Univerſe is ſown and filled with innumerable *Vortices* joined to one another of different Size and Figure, but all of them nearly round. Theſe keep each other in a mutual Equilibrium by their reciprocal Preſſure. In the midſt of every one of theſe *Vortices* is a Star or a Sun, that is to ſay, a large Ball of *ſubtile Matter* that ſtrives to dilate itſelf, and preſſes the *Vortex* all round. This Preſſure of the *ſubtile* communicated to the *globular Matter*, or that of the ſecond Element, gives Birth to *Light* according to the Opinion of *Des Cartes*. The different Bigneſs of the Star, and much more its Diſtance from us, cauſe the Light of it to appear more or leſs lively to our Sight: And hence it is that the Splendor of the Sun in whoſe *Vortex* we are

— with ſuperior Blaze,
Dims the pale Luſtre of the ſtarry Rays.

It is believed that *Syrius*, though his Diſtance from us be more than two

Millions of Millions of *Engliſh* Miles, (according to the Calculation of a celebrated Mathematician) is yet the neareſt Star that we have; becauſe it appears larger than any of the reſt, and its lively and ſparkling Light makes the longeſt Reſiſtance againſt the dazzling Splendor of the Sun.

I ſuppoſe, ſaid the Marchioneſs, that out of Partiality to your *Syrius*, you omit that Star which the Peaſants call *Diana*, and the Poets the Harbinger of the riſing Day, and to whom (comparing earthly with heavenly Things) they give the ſame Honours as to *Aurora*. You muſt take Care, anſwer'd I, not to confound two Things together, which are very different from each other, as a Body that is luminous in itſelf, and one that derives all its Splendor from another; or in other Words, a Sun and a Planet. It is true, that all the Planets, as *Venus* (which in the Language of Aſtronomy is the ſame as your *Diana*) *Mercury*, *Mars*, *Jupiter*, *Saturn*, and our Earth itſelf, were antiently ſo many Suns, and

may

may perhaps (for who can penetrate into the Secrets of Futurity) hereafter be again reſtored to that Honour. I have not yet mentioned to you another Species of Matter, which is called the *Matter of the third Element*, and which has occaſioned the greateſt and moſt remarkable Revolutions that are left upon Record in the Annals of the *Carteſian* Philoſophy. Among the Particles of that *ſubtile Matter* of which the Sun is compoſed, there are ſome that by their rugged and irregular Figure unite and cling together, and by theſe Means form Maſſes that are ſometimes bigger than our Earth. Theſe Maſſes are driven away from the Sun, and repelled to his Superficies. The Preſſure that communicates itſelf from the *ſubtile* to the *globular Matter*, or in other Words, the *Light* is interrupted in that Part of the Sun's Superficies where theſe Maſſes are placed, and from hence they appear to us as Spots, which, turning round with the Sun, eclipſe part of his Splendor and Glory. Flattery perhaps made certain courtly Aſtronomers take

theſe Spots for little Planets, that get betwixt the Sun and us, and made uſe of them to tranſport the Families of thoſe Princes to Heaven, from whom they expected ſome little Penſion on Earth in Exchange for the Inveſtiture of a thouſand Planets which they with great Confidence promiſed them. Philoſophical Politeneſs transform'd theſe Maſſes into Patches upon the Sun's Face; if you are better pleaſed with the Idea under which they were repreſented to the Queen of *Pruſſia* by the famous Mr. *Leibnitz*: who thought that philoſophical Terms ſhould be ſoftened for the Ear of Queens; the Thing is too ſerious to bear a Jeſt, ſaid the Marchioneſs, Patches as big as the Earth might quite demoliſh a Face.

Hitherto (continued I) our Sun has been lucky enough to eſcape this Misfortune. The Motion and Agitation of the ſubtile Matter breaks and diſſipates theſe Maſſes as faſt as they are formed. There once appeared one of theſe Spots, which darkned the fifth Part of the Sun's Disk. This was a

moſt enormous and terrible Bigneſs, enough to make Aſtronomers tremble, and the whole World melancholy. The Sun at laſt diſengaged himſelf, and got the better of it, ſo there is now no reaſon to fear any ſuch unlucky Accident; but all the other Suns were not born under ſuch favourable Circumſtances. There are certain Stars which are conſiderably diminiſhed, ſo that what has formerly been placed by Aſtronomers among thoſe of the ſecond Magnitude, is now hardly worthy of being reckoned among thoſe of the ſixth. This muſt be aſcribed to theſe Spots which by length of Time are ſo increaſed, as to form a Sort of Cruſt almoſt over the whole Star, and conſequently weaken its Light.

On the other Hand, ſaid the Marchioneſs, might not certain Stars arrive to a greater Magnitude, if the Agitation of the *ſubtile Matter* was ſtrong enough to diſſipate part of their Cruſt? You are throughly poſſeſſed, *Madam*, anſwered I, with the Spirit of *Carteſianiſm*: This Sect places its Glory in Conjectures,

and you have made a very good one. But what a terrible Deſolation would it make in the poor Star, if this Cruſt ſhould entirely cover it, (as it too often happens) and ſhould be ſtrong enough to reſiſt the Force of the *ſubtile Matter* that ſtrives to break and diſſipate it? When this is the Caſe, we muſt bid farewel to the Sun or Star which has loſt that Place of Honour which it before held in the Univerſe. Its Light is ſuffocated by the Cruſt, and from a luminous and ſplendid Body, it becomes dark and cold. The force of its *Vortex* is conſiderably weakned as it aroſe from the *ſubtile Matter*, which has now no Communication with the globular. The *Equilibrium* is broke, and conſequently its *Vortex* deſtroyed. Some one of the neighbouring Stars carries it away with it, and now become a Planet, it is forced to whirl round at the Mercy of the moſt powerful. Theſe are the moſt remarkable Metamorphoſes that can poſſibly happen, and to which our metaphorical Suns here below are no leſs ſubject.

When

When theſe begin to loſe their Luſtre and have nothing left to feed that Paſſion which ſo agreeably flatters the Pride of the fair Sex, and which ought to be the Subject of your Philoſophy, they are carried away and become Slaves to another, which for their Conſolation they call Virtue. Our fallen Suns, anſwered ſhe, have at leaſt the Advantage in this, that they acquire a fine Name, and under the Shelter of that they with great Authority condemn what is no longer in their Power to practiſe, and in ſome Meaſure recover their loſt Empire. But what Conſolation is there for a miſerable Sun above, when it is invelop'd with a Cruſt, and changed to a Planet? The Conſolation, anſwered I, of not having an odious and imaginary Empire after having been poſſeſſed of an amiable and real one; the Conſolation, in ſhort, of not growing like an old *Sybil* after having reſembled you.

This miſerable Metamorphoſis of a Sun to a Planet, accompanied however with ſome Degree of Conſolation, is pro-

bably what happened to a fine Star which we have entirely loſt in the Conſtellation of *Caſſiopeia*, and this too according to the *Carteſian* Syſtem was the Fate of our Earth which was once Empreſs of an extenſive *Vortex* crowned with Light, and one of the *brighteſt Eyes* of Heaven; but at length invelop'd with a deform'd Cruſt, unhappily loſt its Power and Splendor, and was carried away by the immenſe *Vortex* of the Sun, as a Straw in a River by the Impetuoſity of a Whirlpool. In the ſame manner the other Planets that revolve about him, *Jupiter*, *Saturn*, *Mercury*, *Mars* and *Venus*, fell Victims to his ſuperior Power; nor could even the Comets eſcape, though theſe are Planets of a peculiar Nature which keep rambling from one *Vortex* to another, and like certain People among us here below, rove from one Country and Government to another. And theſe *Vortices* are the grand Machine invented chiefly by *Des Cartes*, to guide the planetary Dance round the Sun.

Is the Earth then (replied the Marchioneſs, after a ſhort Pauſe) like the other Planets forced to dance round the Sun? And do all the mighty Preparations, you made with *your Matter of the third Element*, amount only to this? The Earth, anſwer'd I, does not need that Concern which you ſhew for her Degradation from a Sun to the inferior Rank of a Planet; ſince by this Means ſhe was deſtin'd to give Birth to you who are but another Name for the moſt charming Thing, that all the *Vortices* of the Univerſe put together could ever have produced. Is not this a ſufficient Compenſation for her Loſs? If it was in the Power of Gallantry, anſwer'd the Marchioneſs, to make her amends, yours would certainly do it. But what can ever free her from the Diſgrace of being obliged among the Crowd of other Planets to whirl round the Sun like a Straw, agitated by the Caprice of a Whirl-pool? I am ſenſible that you Philoſophers look upon the Earth with great Indifference, and ſuffer it to turn round without Regret; but

for

for my Part——let it whirl round for this Time, anſwered I, upon the Word of *Des Cartes*. Hereafter, if you have a Mind to be convinced with Pleaſure, we will read M. *Fontenelle*'s Dialogues upon the *Plurality of Worlds*. There you will ſee a Marchioneſs, who exactly reſembles you in every Accompliſhment of Mind, and whom you have nothing to envy but her Philoſopher. At preſent you are to look upon the Earth only as a Compoſition of the Matter *of the third Element*, which renders it opaque, and as a Body which no longer ſhines by its own Light; and by this Means I believe you will be pretty indifferent towards it. A Gloworm, one of thoſe Reptiles that glitter by Night in the Country, is much more worthy your Attention; whatever is not luminous is nothing to us.

You have ſeen, continued I, what ſort of a Thing Light is: You ſee too how the Sun may continually ſupply ſo great a Quantity of Light as he does, without any Expence to himſelf, which is what gave you ſuch terrible Apprehenſions in the Atomic Syſtem. He has nothing to

to do but to preſs the globular Matter, and this Preſſure coſts him nothing of his own, and ſince it is communicated on all Sides, we are to conclude that he is luminous quite round. The Light, according to *Des Cartes*, is but a Moment in its Progreſs from the Sun to us notwithſtanding the Diſtance of a Million of Miles. The Globules of the ſecond Element are continued from the Sun to the Earth, like ſo many Strings of Beads, and touch one another. In the Inſtant that the firſt in the String moves, or endeavours to move, it muſt alſo endeavour to move the laſt. Juſt as a Pole, though ever ſo long, in the Moment that one End moves, the other moves alſo.

The Meaning of all this is, anſwer'd the Marchioneſs, that by Means of theſe *Vortices* Philoſophers may make and give a Reaſon for every Thing. In a Moment's Time we have produced the Sun, Stars, Planets, Comets, the Earth and Light. I ſuppoſe we ſhall form Colours with the ſame Facility. Nothing more eaſy to *Des Cartes*, I replied. As Motion or a Tendency to Motion in

the celeſtial Matter, raiſes in us the Senſation of Light, ſo the different Motions of this Matter, excite in us the Perception of different Colours, which are nothing but certain Modes in which Bodies receive Light, and afterwards tranſmit it to our Eye. Theſe Modes conſiſt in the Increaſe or Diminution of that Motion, by which the Globules of Light naturally turn round themſelves, and which is called the *Motion of Rotation*. Thus thoſe Bodies whoſe Superficies is diſpoſed in ſuch a Manner as conſiderably to augment this *Motion of Rotation* in theſe Globules of Light which fall upon them, and are thence tranſmitted to us, appear to our Sight red: Thoſe which increaſe the Motion ſomewhat leſs, appear yellow: Thoſe, which conſiderably diminiſh it, appear blue, and thoſe which diminiſh it in ſuch a Manner that theſe Globules turn round ſlower than uſual, appear green; and to conclude, thoſe Bodies, that tranſmit a great Number of Globules of Light without altering their Motion, appear to us white, and thoſe ſeem black,

black, which extinguiſh them, and as it were abſorb the Light. Here then you have the Origin of Colours, do you deſire any Thing more? 'Tis only ſpeaking; the *Vortices* are as uſeful to *Des Cartes* as the Cocao-tree to the *Indians*, which ſupplies them with all they want.

No, no, ſaid the Marchioneſs, let us at preſent confine ourſelves to Colours: I need only increaſe or diminiſh the Motion of *Rotation*, in the Globules of Light, in order to form the Shades of a fine Silk, and variegate the Parterre of a Garden with the different Beauties of Hyacinths, Anemonies and Violets, in ſhort, to diverſify the Face of Nature juſt as I pleaſe. Rather, ſaid I, if this Increaſe or Diminution ſhould give you any Trouble, you need only ſuppoſe the Globules of Light to be intirely deprived of all *Rotation*, which we will grant them only in the very Action of variegating your Silk or Parterre, or in other Words, in being repelled from the Bodies upon which they fall. You may freely chooſe which of theſe Methods ſuits you beſt.

Each

Each of them will equally ſerve your Purpoſe. *Des Cartes* ſeems to have had this too in common with the Phyſicians, that he thought it unworthy his fruitful Imagination to confine himſelf to one ſingle Method of making his Deſigns ſucceed. Notwithſtanding your malicious Inſinuation, replied the Marchioneſs, I think myſelf much obliged to *Des Cartes* for this Copiouſneſs, I dare ſay it will not fail him in explaining how it comes to paſs that one Body ſhould give the Globules of Light a certain *Rotation*, and another Body a different one. You are not confined here neither, anſwer'd I, but have free Liberty of chooſing what Method you like beſt for the Explanation of the Thing in Queſtion, either different Figures of thoſe Particles of which the Superficies of Bodies are compoſed; or their different Diſpoſitions, their different Inclination towards each other, or their being more or leſs ſmooth, and a thouſand other Things that you may imagine to yourſelf. By theſe Means will your dextrous Philoſopher compoſe

poſe not only the Finery of Silks, and the variegated Beauties of a Garden, but all the Elegance of *Paul Veroneſe* or the Delicacy of *Titian*; and hence too ariſes that lively Bloom on your Complexion, which perhaps not all the Art of *Paul* and *Titian* could ever have imitated. I ſhould not have thought, anſwered ſhe, that the colouring of my Cheeks would ever have enter'd into the *Carteſian* Syſtem. It enters, anſwered I, into other Syſtems more generally underſtood, and of ſomewhat more Importance than thoſe of Philoſophy. But even theſe muſt receive great Honour from the Explication of ſo beautiful a Phænomenon.

I proteſt, ſaid the Marchioneſs, that this great Plenty of Cauſes, and above all the Simplicity that reigns throughout this Syſtem, quite charms me, not to ſay any Thing of thoſe Difficulties which it removes in all the reſt. I ſhould be glad to ſee how any other Woman in my Place would guard againſt it. I am too well acquainted with the Language of Ladies, anſwered

ed I, not to believe you already conquered. You have not ſufficiently cloſed your Ears to the Song of this philoſophical *Syren*, nor guarded your Heart againſt the alluring Pleaſures in the luxurious Garden of this *Carteſian* Enchantreſs. But you have forgot that yourſelf at firſt condemn'd this Precipitation in building Syſtems, which cannot afterwards bear up againſt the Obſtinacy of Obſervators. Hypotheſes or imaginary Syſtems, cannot long reſiſt the force of Experiments, which are juſtly called by a Man, who carried them farther than perhaps any one that may follow him, Natural Revelations. A Liar, even if he was as ingenious as he in *Corneille*'s Comedy, will at laſt be found out. I had no Notion, ſaid ſhe, that ſo many Things could have been produced from ſo little a Matter, as theſe whirling Particles, and I think upon this Account a little Precipitation might be excuſed, and all this moralizing laid aſide. I am extremely fond of the *Chineſe*, becauſe I am told they effect whatever they take in Hand, with much

much fewer Inſtruments and leſs Apparatus than we do. And I think *French* Muſic much preferable to ours, becauſe by a few ſimple and plain Notes it touches the Heart, and moves the Paſſions. Whereas ours, with all its Diviſions, Fugues and Shakes, leaves us for the moſt part in a tedious and ſtupid Tranquillity. Thoſe, who for every little Thing, make uſe of ſuch great Machines put me in Mind of the Dictators antiently elected at *Rome*, with the utmoſt Solemnity, and who never omitted chooſing a Maſter of Horſe for no other End, than to fix a Nail in the Capitol. You may add, ſaid I, ſince you ſeek for Examples illuſtriouſly ridiculous, thoſe Kings of *Perſia*, who never eat, walk, or go into the Seraglio, till an Aſtrologer, after many Obſervations and Calculations, has aſſured them, that it is a lucky Time to undertake one or other of theſe important Enterprizes. If we had been in *Perſia*, how many Aſtrologers, how many Calculations, muſt there have been employed before you could have been made

made a Philoſopher! which I take to be a Thing of much greater Importance, than the walk of a King. I am afraid, anſwer'd ſhe, that before the Aſtrologer had finiſh'd his Calculations, my Inclination for Philoſophy would have left me. But Thanks to any good Fortune, that I was born in a Country, where if we have a Mind to walk or hold philoſophical Diſcourſes, we may do either without giving the Stars or the Sky any Trouble about it. You ought rather to thank your good Fortune, *Madam*, anſwer'd I, for being born in a Country where your Charms are not like thoſe of the Eaſtern Beauties, confin'd to the narrow Limits of a Seraglio.

With theſe Reflections of yours, ſaid the Marchioneſs, you will make me loſe Sight of our Colours, whoſe Variety Charms me the more, becauſe the Production of them coſt me ſo little Trouble. But how ſhall we produce thoſe various Colours which appear in looking through a certain Glaſs which I once ſaw placed over-againſt a Window,

dow, perhaps you have ſome other ſort of Motion to produce theſe Colours which only appear to be in Objects, when they are looked upon through one of theſe Glaſſes. You may form theſe, anſwered I, in the very ſame Manner as the firſt. You need only make the Globules of Light that paſs through the Glaſs you mention'd, (which is called a *Priſm)* turn round according to thoſe Rules you have already learnt, and according as the variety of Colours which it produces require. As to that Diſtinction, which you ſeem to put between thoſe Colours which are really in Bodies, and thoſe which are ſo only in Appearance, *Des Cartes* will not grant it you, for he, as well as the Atomiſts, (as you may remember) aſſerts that there are abſolutely no Colours in Bodies, and that they only appear to be ſo. Thus for Inſtance, betwixt the red on your Cheeks, and that in the Rainbow, or *Priſm*, there is no ſort of Difference, only perhaps it would be more pleaſant to make Obſervations on one than the other. But

after

after all, they are of the ſame Nature and only apparent. Do you think continued I, laughing, that ſo many Poets would have compar'd fine Ladies to the Rainbow, if there had not been ſome Reſemblance in their Colour? As, for Example, one of the greateſt Poets in our Time has done in thoſe ſublime Verſes, where he is deſcribing ſome Beauty who perhaps reſembled you.

[a] *Tale in ſomma ne gia qual di Rubini*
E d'or ricca, e di Gemme e d'oſtro adorn
Sorgér veggiam la Matutina Aurora.
O qual ſul variato e lucid Arco
Apparir ſuol dopo nemboſa pioggia
Di Taumante la Figlia; allorchè, i venti
Si ſtan Soſpeſi a vagheggiarla e intanto
L' Inſano Mar depon l'Ira, e s'achera

You ſee, ſaid I, that one of the moſt ſplendid and pompous Similies, that

[a] As Seignor *Algarroti* does not mention where he had theſe Verſes, I would not venture to tranſlate them from the *Italian*, ſince I am not certain, whether they were not originally written in *Engliſh*.

Poe

Poets have in their whole Collection, would have been guilty of too eſſential n Error.

Seriouſly (anſwer'd the Marchioneſs) always thought that the Colour on ny Cheeks, whatever it be, was really here, and that the Colours in a Priſm the Rainbow were only in Appear-nce; pray explain this Paradox to me, hich, to ſay Truth, I am very much erplex'd with; and deliver me from e Uneaſineſs I cannot help feeling on our Comparing me to the Rainbow, not-ithſtanding you made me a great Com-iment by this fine Simile. This, ſaid is reducing Things to that Simplicity u ſeem'd ſo fond of, by taking away e Diſtinction which you put between al and apparent Colours. But the In-reſt you have in this Diſtinction, and ur ſelf Love, that makes you trem-at the Thoughts of loſing your eſs and Lilies, (to ſpeak in the Paſ-al Style) has at preſent got the better your Love of Simplicity. I'll engage re are many Ladies who would e the ſame Scruples: But after

all, you cannot with Honour adopt a Syſtem without being willing to admit the Conſequences. We have before ſaid that there is in Bodies only a certain Diſpoſition and Texture of Parts, and in the Globules of Light a certain Rotation which theſe Parts give them. Theſe Globules in a certain Manner tickling and ſhaking the Nerves of the *Retina*, which is a very thin Membrane at the Bottom of the Eye, give us the Idea of ſome Colour, which we by the Help of our Imagination refer to the Body from whence thoſe Globules of Light are deriv'd to us. But I think we are called to Dinner, and 'tis Time for us to ſee what Taſte our Imagination will help us to give the Soup. Our Imagination, replied the Marchioneſs, I do not know whether he, who has laboured this three Hours to give it a real Taſte, will be very well pleaſed with you philoſophical Gentlemen, who would reduce every Thing to mere Appearance: I dare ſay, anſwer'd I, that he will give himſelf very little Trouble about ſuch a Trifle as a philoſophical

Opinion

Opinion. But however, if he did, he must bear it; for as Bodies are in Reality without Colour, so they are likewise without Taste, Smell, Sound, Heat, Cold, and even when they appear most luminous, without Light.

The Marchioness was very desirous that I should explain this Paradox more fully: But I assured her, that if we stay'd till the Soup wanted heating again, not the finest and most simple Explications in the World would help our Imagination to give it a good Taste. She was fully convinced of this Truth, and we ended our Discourse in the Manner of *Homer*'s Gods, who after their Consultations are sure never to forget their Ambrosia.

DIALOGUE *the* SECOND.

That Qualities, ſuch as Light, Colours, and the like, are not really in Bodies. Metaphyſical Doubts concerning our Senſations of them. Explication of the general Principles of Optics.

ALL the while we were at Dinner the Marchioneſs entertain'd herſelf with making the Globules of Light turn round, ſometimes one Way, ſometimes another, as the different Colours of the Objects before us requir'd, and look'd upon herſelf, as ſhe ſaid, to be the Empreſs and Arbitratreſs of Nature, ſince ſhe was poſſeſs'd of Materials to diverſify it as many Ways as ſhe pleas'd.

pleas'd. As ſoon as Dinner was over, and we had return'd into the Garden, I am ready, ſaid ſhe, to deprive the Soup of all Taſte, and willingly renounce every Colour, even what I had the greateſt Fondneſs for. In ſhort, I will be quite a *Carteſian*, provided you can furniſh me with good Reaſons. Theſe Globules, 'tis true, lead me to ſtrange Conſequences, but perhaps they may furniſh me with ſome Expedient to evade them. You treat Philoſophy, anſwer'd I, as Attorneys do the Law. But there is no Expedient that will hold good at the ſevere Tribunal of Reaſon. Not all the Monarchs in the Univerſe, nor all the Beauties which are far more powerful, can influence the impartial Judgment of Philoſophy, nor induce it to interpret the leaſt Text in their Favour. This is a Trial, a Mortification that *Des Cartes* will make you undergo in your Novitiate of Philoſophy. But are you terrified at ſo ſmall a Hardſhip as this? Take Courage and fear nothing; you will at laſt add to the Pleaſure, you receive from your Senſes,

that of contending with them, and giving them no Credit.

Hitherto, ſaid the Marchioneſs, I have only the Mortification of ſeeing that we are under a perpetual Deluſion, ſince, if what you ſay be true, Things appear to us very different from what they really are. Bodies appear to us of a certain Colour, whereas there is really nothing elſe in them but a certain Diſpoſition of Parts. They ſeem to us to be hot, cold, and yet they are poſſeſs'd of none of theſe Qualities. Really I cannot help thinking, that we are in a very ſtrange Condition. It is certainly very ſtrange, anſwer'd I. Our Knowledge can make but very little Progreſs, unleſs it be conducted by the Senſes. They continually make us believe Things which a more refin'd Senſe, or our Reaſon, afterwards contradicts. You think, for Inſtance, that your Hands which have been the Subject of ſo many fine Verſes, are ſmooth and poliſh'd; and poſſibly might be greatly offended, if any one ſhould dare to diſpute them this Quality. And yet if you were to look upon them through

through a Microſcope, you would be ſurprized to ſee a great Number of Pores that ſeparate the Texture of them, and to find that they are cover'd with Scales like thoſe of a Fiſh. You would diſcover in them Cavites, Promontories; Valleys and Hills, for the Abode of a Nation of little Animals, who perhaps ſpend their Life there. And to increaſe your Wonder, you would be preſented with the Sight of Rivers and Seas. In ſhort, you would not know them again, and you would be obliged to confeſs that they are very different from thoſe which your Poets deſcribed. Nature, ſaid the Marchioneſs, has done us a great Favour in not making our Senſes too refined. It would be very bad for us, if our Touch was exquiſite enough to feel all that the Microſcope diſcovers to our Sight. We ſhould certainly be extremely unhappy, anſwer'd I, if our Senſations were ſo perfect, that in handling the ſmootheſt Surface our Touch ſhould fail us at every Pore, and every little Eminence ſhould make us ſhudder. It is to the Silence of our Reaſon, and

the want of more refined Senſes, that we owe our Perceptions of Pleaſure. And he gave a very juſt Definition of our Happineſs, who affirm'd, that the moſt tranquil Poſſeſſion of Pleaſure conſiſts in our being agreeably deceiv'd.

It muſt be confeſs'd, replied the Marchioneſs, that our Sex is greatly obliged to the Complaiſance of Philoſophers, who, notwithſtanding they are ſo well acquainted with the Nature of our Superficies, are ſo genteel as to behave towards us like the reſt of Mankind. But if I had a Mind to pleaſe any ignorant Perſon, the very firſt Thing I would do, ſhould be to forbid him the holding any Correſpondence with thoſe Gentlemen who deal in Microſcopes; for theſe might do me a very great Prejudice. Not all the Microſcopes nor all the Philoſophy in the World, anſwered I, could ever hinder your appearing agreeable to the naked Eye, and even a *Cleopatra* might be contented with this. *Virgil* makes *Corydon* warn his *Alexis* not to confide in his beauteous Colour. But I may freely

ly give you leave to confide in your *Hands*.

As our Senſes are not microſcopical, ſo neither are our Hearts philoſophical. It would be very bad for us, if our Pleaſure was in the Hands of Philoſophers, and if Beauty, in order to prove its Exiſtence, muſt ſtand out againſt all the Experiments of a Naturaliſt. This is juſt as if the Chaſtity of a Lady ſhould depend upon the ill-grounded Suſpicion, and diligent Enquiry of a jealous Husband. Theſe two Kinds of Men have this in common, that they both equally tend to deſtroy the moſt valuable Things in the World.

But Philoſophers, ſaid the Marchioneſs, deſtroy without Mercy, for they can leave but very little elſe to Bodies, after they have deprived them of Colour, Taſte and thoſe many other Qualities which they have taken from them. They leave them, anſwer'd I, in Poſſeſſion of Extenſion (that is, Length, Breadth, and Depth) Impenetrability, Motion, Figure, and all the fine Things that

Mathematicians and Mechanics deduce from theſe Qualities, upon which I could produce you ſo many formidable Volumes, that all which has been written upon the *Cruſca*, would ſeem compared to theſe no more than a King's Declaration of Love. Do not you think it enough for Bodies that they are no more than Bodies? Beſides, what Philoſophers do with regard to thoſe Qualities we were ſpeaking of, is not properly a Deſtruction: They take nothing away from Bodies, but what was falſely applied to them, and what they had long unjuſtly poſſeſs'd; and reſtore thoſe Qualities to us, to whom they rightly and properly belong. Preſcription has at preſent no Influence on Philoſophy, as it formerly had. If a Lover for Example ſhould ſay, that there was Hope in a certain favourable Glance, which had darted on him through a Fan, what Harm would a Philoſopher do, who without deſtroying either the Hope or the Glance, ſhould tell him that there was nothing in the Glance, but a particular Motion of the Eye, cauſed by

certain

certain Muſcles, either from a Principle of Pity, or (if we would trace the Thing to its Original) Coquetry. But that the Hope was intirely in himſelf, and excited by the Means of that Glance. Juſt in the ſame Manner, when we are pricked with a Needle, the Pain is intirely in ourſelves; and there is nothing in the Needle, but a Motion by which it disjoins and lacerates the Fibres of our Body; this Separation is the Cauſe that we feel Pain. In ſhort, Bodies are only Matter, and conſequently can have no Properties but what depend on Matter; and theſe the *Carteſians* have confin'd to Extenſion, mutual Impenetrability, Diverſity of Figure, and a different Diſpoſition of Parts. And theſe are ſufficient to give Bodies a Power of exciting different Ideas in us, as thoſe of *Light*, *Colours*, Taſte, and the like. It is not neceſſary, for Inſtance, that Colour ſhould really be upon the Surface of a Body, in order to make me ſee that Colour, any more than it is neceſſary for Pain to be in a Needle, in order to

make me feel it when I am pricked. It is ſufficient that as the Needle cauſes a certain Diſpoſition in the Fibres of my Body, by the Means of which I feel the Pain, ſo that particular *Rotation*, which is in Globules repelled from the Surface of a Body, ſhould cauſe another Motion upon the Nerves of the *Retina*, which carried from theſe to the Brain excites in me the Idea, or as they call it, the Senſation of Colour. Thus, if in any Body there be a certain Motion by which it preſſed the Globules of the ſecond Element, and theſe Globules be carried to our Eye, they will raiſe in us the Idea of Light. A certain Configuration of Particles, or perhaps certain little Animals which are in Bodies, by playing upon the Nerves of the Tongue in ſuch a particular Manner, raiſe in us the Senſation of ſome Taſte. Theſe Senſations are generally raiſed in us by Means of certain Bodies, and becauſe we ſee neither their Particles nor the little Animals which are in them, the Globules of the ſecond Element, nor the Impreſſion which is made

made upon our Nerves, we aſcribe to thoſe Bodies both Light, Colour and Taſte, which in Reality are only in ourſelves. Reaſon at length convinces us of the Illuſion which our Imagination continually puts upon us, and aſſures us, that the delightful and hitherto undefin'd Taſte of the Pine-apple, the pleaſing Verdure of a Meadow, and even the Light of the Sun which animates and revives the whole Univerſe, are all our own.

I underſtand you, ſaid the Marchioneſs, we are inrich'd at another's Expence, and are like antient *Rome*, which founded its Grandeur on the Spoils of the whole Univerſe. Philoſophy would be in a bad State, anſwer'd I, if its Rights had no better Foundation, than thoſe of Policy and Ambition. I ſee you have not yet a right Notion of it. In order to convince yourſelf that Philoſophy is no Uſurper, but only takes its Due, preſs one Corner of your Eye with your Finger, and you will ſee on the oppoſite Part a round Flame of a reddiſh Colour. In this Caſe there is certainly

certainly neither Light nor Colour without your Eye. The only Reaſon of your ſeeing them is the Preſſure which your Finger makes upon the Nerves of your Eye. The Globules of Light which flow from the Surfaces of Bodies, occaſion the ſame Effect upon the Eye as your Finger, only their Operation is more imperceptible. The different Diſpoſition and Configuration of the Parts of a Body, are the Reaſon why the Globules make different Impreſſions upon us. The Power of a Body's exciting in us the Idea of any particular Colour, conſiſts alone in this Diſpoſition, and the Configuration of its Parts. Is it not evident from hence, that if this Diſpoſition be changed, the Colour is changed alſo? which could not happen if the Colour was really in the Parts of the Body itſelf. Coral, which is of a fine red, if it be ground to Powder turns pale. One Liquid mix'd with another changes its Colour. The Reaſon of all this is, that the Diſpoſition and Configuration of the Parts of theſe Bodies, are changed by being ground or mixt,

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and from hence they tranſmit the Light to us in a different Manner, and conſequently our Idea of the Colour is changed; from no other Reaſon proceed the venerable white Locks of old Age; the tranſient Whiteneſs of many Animals of the North in Winter. From hence too it is, that certain Roſes in *China* are in the ſame Day both white and purple. From this Cauſe ariſes that ſurpriſing Variation of Colour which generally follows the Change of Paſſions in the Camelion, which has furniſh'd the Moraliſts and Poets with ſo many Alluſions, the Antients with ſo many Fables, and the Moderns with ſo many fine Obſervations. And what is it elſe but one Diſpoſition which hinders us from ſeeing you Goddeſſes when you firſt riſe, and another which gives you to our Sight and Adorations after you have ſpent two or three Hours in the ſacred Rites of the Toilet?

I perceive, replied the Marchioneſs, that there is nothing ſecret to Philoſophy; we may hide ourſelves from Men, but not from Philoſophers. And indeed

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to what Purpoſe would it be for us to endeavour to conceal ourſelves from a Set of People who are quick ſighted enough to diſcover the Globules of Light indued with a certain Motion, and thoſe Nerves and Fibres to which this Motion is communicated and thence convey'd to the Brain? A Sight which mortal Eyes have never yet penetrated into. But I muſt confeſs, I ſtand in Need of your Aſſiſtance to guide me through this obſcure Labyrinth. I do not ſee what Relation all theſe Motions have to any Colour that I have a Conception of. This is a Thing which ſeems to me quite different from theſe Motions. Have you any better Conception, anſwer'd I, of the Relation between the Idea of Pain, and a Separation of the Fibres of your Hand? Or between the Idea of Hope and a certain Motion in the Muſcles of an Eye? And yet you ſee that theſe Things are in Fact connected, and that the one is the Cauſe, or at leaſt the Occaſion of the other. You ſeek for more than it is poſſible to give you. Un-

Unhappily for us, thoſe Things which are of the greateſt Importance to human Knowledge are the moſt doubtful. Who can tell you in what manner Objects occaſion certain Ideas in the Soul, and how the Soul on the other Hand gives certain Motions to the Body? How the Soul which is unextended yet is preſent in every Part of our whole Machine, and though incapable of being ſeen or felt, yet ſees and feels every Thing? Philoſophers can with a great deal of Eaſe tranſmit the Motion of the Globules of Light, (or any other Motion) to the Nerves, and from theſe to the Brain, where they all terminate, either by Means of a Fluid that runs through them, or a certain Tremor raiſed in them. Nay, Philoſophers will go yet farther, and tranſmit this Motion to certain Parts of the Brain which are imagined to be the Seat of the Soul. But how theſe Motions, when they are arrived to the Brain or Seat of the Soul, ſhould produce in it different Ideas, is an abſolute Myſtery. This Paſſage, which in Appearance is ſo ſhort,

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is to Philoſophers what the innavigable Ocean was to the Antients. What Communication, what Connexion can there be between Body and Soul, between Extenſion and Thought, Motion and Idea, Matter and Spirit? What ſort of Communication theſe can have with one another, is beyond the Reach of our Imagination. The ſame, anſwered ſhe ſmiling, that *Æneas* had with the Shade of his Father *Anchiſes* in the Elyſian Fields. They mutually communicate the moſt agreeable Things in the World to one another. But when *Æneas* attempts to embrace the old Man, he vaniſhes away and is diſſipated into Air.

We may draw a fine Allegory from this Paſſage, anſwered I, which would have done great Honour to a learned and muſty Commentator of the laſt Age. Now in order to put your Allegory in a clear Light, and to let you ſee on the other Hand that nothing is able to diſcourage a Set of People brought up and educated in the midſt of Difficulties, ſome of them will tell you, that there

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is a certain Correſpondence or pre-eſta-bliſhed Harmony betwixt Soul and Body, ſo that though they have no more Connexion with each other, than a Harlequin Dance in our Operas has with the Death of *Dido*, or the Fate of *Rome*; yet by Virtue of this pre-eſta-bliſhed Harmony, at the ſame Time that certain Motions happen in the one, certain Ideas and Deſires ariſe in the other. In ſhort, that they are like two Clocks independent of each other, whoſe Weights are adjuſted in ſuch a Manner, that when this ſtrikes One, that ſhall always ſtrike Two, and ſo on. Your *Des Cartes* will tell you that upon Occaſion, when Bodies without us in the material World excite certain Mo-tions in our Body, the Soul ſees cer-tain Ideas in the intellectual World. So that in the material World, you have nothing but Extenſion and certain Motions, and Configurations, and what-ever other Qualities you poſſeſs, and which render you ſo agreeable and charming, exiſt only in the intellectual World. Others will tell you, that by

Means

Means of certain Motions in the Body, God reveals and diſplays certain Ideas to the Soul. But they have ſo little Regard for any Connexion between theſe Motions and our Ideas, that they affirm, we might as well hear with our Eyes, or ſee with our Ears, provided the Laws of the Union of the Soul and Body were different from what they now are, which is not impoſſible, ſince theſe Laws are merely arbitrary. One of the Laws of this Union is, that when there are certain Motions impreſs'd on one of the Membranes of the Eye, the Idea of Light ſhould be raiſed in us, and in the ſame Manner, when certain Motions are made upon a Membrane of the Ear, we ſhould perceive the Idea of Sound. And as theſe Things are independent of one another, why might not the Idea of Light ariſe from certain Motions upon the Ear, and that of Sound from certain Motions impreſs'd on the Eye?

And why (ſaid the Marchioneſs) may we not rather ſuppoſe that there are ſome ſecret Dependencies between theſe Things, which your Philoſophers may

may not have been acquainted with? The Vulgar hide their Ignorance under the Vail of Obſtinacy, and do not the Learned endeavour to conceal theirs in Doubts and Queſtions? Your Suſpicion at leaſt is reaſonable, anſwer'd I. Our Horizon is but faintly illuminated with the Beams of a glimmering Twilight, and we pretend to ſee as clearly as if it was full Day. We continually act (eſpecially with regard to Metaphyſics) as *Columbus* would have done, if he had pretended to write us a complete Deſcription of *America*, and given an Account of its Inhabitants, Rivers, and Mountains, when he had only ſeen a little Tract of this Country, and did not know whether it was an Iſland or a Continent. We reaſon upon the Chimeras of our own Fancy, we deſtroy and build Syſtems, we raiſe Doubts, and think to reſolve them without agreeing upon ſo much as their firſt Ideas. One of the moſt elegant Genius's of *England*, who in our Days has revived the polite Court of *Charles* II. in that happy Country, in a little, but very

very valuable Piece which he wrote againſt one of the moſt celebrated Metaphyſicians of our Time, compares thoſe Gentlemen to fine Riders in a "Manage, who ſhow their Addreſs "and Dexterity by making their Horſe "go backwards or ſideways, and all "Ways, and at length after having "laboured round and round for two or "three Hours, get down juſt where "they got up." However it be with theſe metaphyſical Jockies, it is certain, that ſome Things produce others very different from them. The *Americans* without doubt would be extremely ſurprized to hear that certain Cyphers, as the Letters of the Alphabet, could tranſmit the Hiſtory of a Nation to Poſterity, and furniſh two People with Means of communicating their Thoughts, quarrelling or making Love at the Diſtance of four thouſand Miles, juſt as well as if they were preſent with each other. And would not a *Chineſe* be greatly aſtoniſh'd to ſee that certain Marks drawn upon Lines ſhould produce

duce Sounds, Concords, and in ſhort, a Concert of Muſic?

As I imitate theſe in their Surprize, replied the Marchioneſs, I will imitate them too in their Docility, which they diſcover in embracing whatever we teach them as reaſonable even at the Expence of their Self-love. We muſt then ſolemnly abjure all thoſe Charms which you call Roſes and Lilies, and ſubmit to that Philoſophy which deprives us of them, perhaps to give us in Exchange ſome greater Good. I admire your Moderation, anſwer'd I, in agreeing to this *Carteſian* Philoſophy, which, to ſay Truth, is ſomewhat injurious to fine Ladies. When the Philoſophy of *Ariſtotle* was in Vogue, who aſſerted that Qualities were really in Bodies, the Ladies might be ſomething vainer of their Beauty. But now they muſt renounce the very Things upon which that Vanity was principally founded. It is true, that with Globules alone, a bare Diſpoſition of Parts, you will ſtill continue to make the ſame Conqueſts as you did before with the Help of Colour

Colour itſelf. But it is true on the other Hand, that it is for ever gone without any Hopes of being recovered again. However, if you are afraid that this Syſtem may do you any ſort of Injury, you need only name the Perſon whom you have a deſire to pleaſe, and I will promiſe you never to let him into the Secrets of Philoſophy.

Till there appears another Syſtem to deprive us of that Diſpoſition of Parts which this leaves us, replied ſhe, I do not ſee, that we have any Thing to fear, ſince after all, one certain Diſpoſition has only one certain Idea affixed to it. So that the Diſpoſition, which excites the Idea of a fine red in you, cannot produce that of a yellow or brown in another Perſon. And thus I think we are ſecure. Seriouſly (anſwered I) I do not at all doubt that Beauties are ſecure in any Syſtem of Philoſophy whatever. But that a certain Diſpoſition of the Parts of a Body ſhould excite the ſame Idea in all Men, is what I cannot aſſure you of. Who can tell whether the Leaves of theſe Trees that

I ſee

ſee of one Colour which I call green, may not appear to your Sight of another Colour which I ſhould call red or yellow, or perhaps of ſome other Colour, of which I have no Idea? You would render me too philoſophical, ſaid the Marchioneſs, and after this I ſhall be utterly at a Loſs how to converſe with Mankind. You have made me already rob Bodies of Light, Colours, Taſte, Smell, and every other Quality which theſe have never made any Scruple to grant them, and would be greatly offended at any Attempt to take them away. But not content with all this, you would have me confeſs that a Colour which appears green to ſome, ſhould ſeem to others red, yellow, or ſome other Colour, perhaps of which I have no Idea. Is it poſſible to offer a greater Affront to Mankind, than to contradict a Thing they are ſo certainly perſuaded of, and aſſert that they do not all ſee Colours in the ſame Manner? I will venture to tell you ſtill more, anſwer'd for to ſhew a Regard to Mankind whom you ſeem ſo fearful of offend-

ing) in this Point, is not poſſible for any one who has ever converſed with them. Who can tell whether theſe very Trees, which I ſee of one certain Height, may not appear to you of another? So that what I for Inſtance call ten Foot high may appear to your Eyes of a Height which I ſhould call eight, or twenty Feet. You have a Mind to divert yourſelf at my Expence, ſaid the Marchioneſs, interrupting me. We both agree in calling this Tree ſo many Foot high, as well as in calling the Leaves green. How then can what you ſay be true? We agree, anſwered I, in Words, but perhaps not in Things. Two People, one of which ſhould give a chief Magiſtrate the Name of King, from whoſe good or ill Adminiſtration depend the Life and Properties of his Subjects, and the other ſhould give the Name of King to a chief Magiſtrate, who is only the Ratifier and Guardian of the Laws of Nature, to which he, as well as the reſt, is ſubjected. Theſe two People would both agree in the Sound, by which they denot

denote their chief Magiſtrate, but not in the Idea which they annex to this Sound. Both you and I had a certain Meaſure at firſt ſhewn us, which tho' it appears to you of a different Size from what it does to me, yet both of us agree in calling it a Foot, becauſe we were told that Mankind diſtinguiſhed ſuch a Meaſure by that Name. According to this, which is the Rule of our Menſurations, we both ſay that this Tree is ſo many Foot high, though it may appear to me of a greater or leſs Height than it does to you, and ſo every other Thing in Proportion to the different Idea we may poſſibly have of a Foot. Who can tell then, but you may appear to yourſelf, and I to you, like one of *Gulliver's Brobdingnagians*, on the contrary each of us may appear to my Sight as ſmall as a *Lilliputian* does to yours, and who knows too but you may ſee the whole World after the Proportion of my *Brobdingnagian*, and I of the ſame Size as your *Lilliputian*; ſo that if it were poſſible for us to ſee with each other's Eyes (which would be a

good exchange for me) you would deſpiſe the diminutive Size of my *Coloſſuſes*, and I ſhould tremble at the Gigantic Stature of your Pigmies. We may eaſily transfer the ſame Way of reaſoning to Colours. We here too agree upon Names, but may very probably differ in Things. Each of us for inſtance calls the Leaves of this Tree green, becauſe we were at firſt told that the Colour of Leaves was green; but it is poſſible, that if Things could appear to your Eyes as they do to mine, you would be ſurprized to ſee theſe Trees and the whole Country clothed in a Colour which you perhaps might call Purple or ſome other. Becauſe we ſee that all Men reſemble one another in the make of their Body, when they have all two Eyes, one Mouth, two Legs, and two Hands, we are led to imagine from thence that they muſt alſo reſemble each other in their Ideas, and from hence ariſe many Inconveniences in Society which would not have happened, had Men been a little more philoſophical than they are. From hence

hence it is, that a Politician, when you are thinking on ſomething quite different from his Projects, will plague you with a long Account of the End and Intentions of all the Privy Councils in *Europe*, and the Diviſion which he has already made of *Italy*, for he thinks it impoſſible that a Man, who reſembles him in his outward Appearance, ſhould not equally intereſt himſelf in his viſionary Schemes. From the ſame Cauſe a Lover will talk you dead with the Hiſtory of his continual Sighs and hopeleſs Paſſion. In ſhort, this miſtaken Notion gives Birth to numberleſs other Inconveniences in Society. None greater, ſaid the Marchioneſs, than the Philoſophers who endeavour to reverſe the Ideas that Mankind have form'd to themſelves, and make us believe that we do not all ſee the ſame Thing of the ſame Size and Colour. Cannot you find ſome Method to explain to me whether the World really appears ſo different to different Perſons, as you ſay it does?

It is not poſſible, anſwer'd I, to find ſuch a Method as you require, un-

leſs there could be any one Meaſure which all Men were certain of ſeeing abſolutely of the ſame Size, and certain Colours which, in the ſame manner they could be aſſured, appear the ſame to all Eyes, and to theſe they might refer all other Colours, as well as all other Sizes to the Meaſure. As thoſe two People who make uſe of the ſame Word *King* to ſignify their chief Magiſtrate, though the one be in Effect very different from the other, can never come to a clear Explanation of the different Ideas they would annex to the ſame Word, unleſs they define and compare it with other Words, and more ſimple Ideas, ſuch as both Parties are agreed upon. Now red, yellow, and the ſmalleſt imaginable Meaſure, are in themſelves ſuch ſimple Ideas, that they can neither be defined nor compared with other Ideas more ſimple. Therefore we have no way of knowing whether all Men have the ſame Conceptions of them, or not, ſo that Mankind are much to blame in being ſo confident that the World appears

pears in the ſame manner to all, for it is a great Chance but they are miſtaken in this Affair.

But what ill Conſequences can there poſſibly follow from our ſaying that the World appears to every ſingle Man different from what it does to all the reſt? Nay, if we ſhould go farther, and ſay that even the World itſelf does not exiſt, and that all theſe Bodies, this Sun, theſe Stars, and theſe fine Ladies, are nothing elſe but Dreams and Appearances. There is one Philoſopher who affirm'd that a Perſon need only to have ſlept once in his Life-time, to be convinced of this. So that while ſome are diſputing about the Manner in which the World exiſts, others abſolutely deny that it exiſts at all. But though I have ſlept more than once in my Life, I will not preach up a Syſtem to you which would mutually deſtroy us both. I will rather aſſure you, that though we really ſhould ſee the World in different Manners, yet I am willing for my own Intereſt to conſult your Preſervation. They will all agree in ſaying, that this Tree

is ſo many Feet high, and the Leaves green, and that you are of a juſt Height and a fine Complexion; and does not this Difference of Ideas diffuſe an infinite Variety over the whole Syſtem of Nature, which ſeems even in the minuteſt Things to take a Pleaſure in diverſifying herſelf a thouſand Ways? But what a Pleaſure muſt you find in imagining yourſelf to appear to ſome under the Height of a wax Baby, and to others as tall as the Image of *Flora* at *Farneſe*. To ſome of an azure Complexion, with the green Locks of a *Nereid*, and to others of a Vermilion Dye, and adorn'd with the roſy Treſſes of *Aurora*, and under theſe different Aſpects, to be agreeable to all, and adored under various Forms, as the Goddeſſes formerly were among the Antients. I muſt confeſs this Imagination, that every ſingle Man ſees the Face of the World in a manner different from all the reſt, though (if you will have it ſo) it be a doubtful Point, gives me ſo much Pleaſure, that I make no Scruple of carrying it beyond

yond Size and Colours, to Taſte, Smell, and all other Qualities. I ſaid, *if you will have it ſo*, only out of Complaiſance to you, for if it be conſidered how very different the Nature of Things is from what it appears to our Sight, ſince we reckon for Inſtance thoſe Bodies to be ſmooth and ſolid, which are in Reality full of Pores, Cavities and Riſings, and imagine them to be indued with Colour, Taſte, and other Qualities which exiſt only in ourſelves: When we conſider too that the ſame Bodies have a different Appearance according to their Diſtance and the other Circumſtances in which they are ſeen; when all this, I ſay, is well conſidered, I do not know whether we may not affirm that every ſingle Man ſees them in a different Manner from all the reſt, and that our Judgment is as much deceived in ſuppoſing that the ſame Things raiſe the ſame Ideas in different Perſons, as it evidently is in the other Reſpect; at leaſt we may reaſonably doubt whether it be not ſo. You will ſay perhaps, that this is ra

ſing Doubts and Queſtions to hide our Ignorance. But it is however one of the Parts of a Philoſopher to ſearch for Motives upon which he may form rational Doubts upon Things, or rather (ſuch is our Misfortune) this is the beſt Part of Philoſophy. However, we every Day clearly ſee that the ſame Objects do in Effect appear differently to different Perſons. Not to ſay any Thing of the more important Affairs of Morality, Law, and Politics, where what is eſteemed in one Nation an Object of Veneration and Reſpect, is reckoned ſcandalous and deteſtable in another. Did not the Ladies in one Age drive all the Colour out of their Cheeks, and affect a pale languid Look, which were capable of inſpiring the moſt lively Sentiments, at a Time when a painted Face would have been as ſhocking as a Fury. But in the next Age this very Fury becomes a *Venus*, and inſtead of Sighs and fine Speeches, the pale Beauties are recommended to the Care of a Phyſician, or the uſe of *Spaniſh* Wool. Were not the very ſame Graſ-

hoppers

hoppers, that weary us with their troubleſome chirping, called by an ancient Poet the *Sweet* Harbingers of the Summer? There are whole Nations who eſteem black Teeth a ſingular Beauty, and others who paint one Eye white, and the other red or yellow. In ſome other Countries, a Beau ſcarifies and gaſhes his Face to appear more agreeable to the Eyes of a brutiſh Creature, who is alone the Miſtreſs of his Heart. An olive Complexion joined to a long Head, a Pair of deep ſunk black Eyes, a flat Noſe, and the Feet of a Baby, are Charms that make great Havock in the Hearts of the *Chineſe*, and occaſion whole Volumes of gallant Verſes and Love Epiſtles. Our *Galatea's* and *Venus's* would not get ſo much as one *Billet Doux*, or a ſingle Ode there, but would be looked upon as mere Caricatures. In the ſame Country Learning is a Step to the higheſt Honours of State, and there is more Ceremony in making a Doctor there, than the *Polanders* uſe in electing a King. Are not Muſic and Dancing, which are with us (as anti-

tiently among the *Greeks)* an Exerciſe for Perſons of the firſt Rank, looked upon in *Perſia* (as they formerly were at *Rome*) as ſcandalous Employments? And would not the ſame Ladies, who cauſe ſo many Commotions and Diſturbances in *Europe*, be cloſe confined in a Seraglio and guarded by Eunuchs in the Eaſtern Countries? If you will not conſent to admit a different Appearance of Things between Men, yet you muſt allow it to be ſo with regard to Nations, (as for Inſtance, between us and the Orientals) unleſs you will except ſome particular Follies which ſeem to have uſurped a more extenſive and univerſal Right over Mankind. The antient *Greeks*, the *Romans*, *Orientals* and *Americans*, tho' ſeparated from each other by ſuch vaſt Tracts of Land and ſo many Seas, yet all agreed in the ridiculous Notion, that when the Moon was in an Eclipſe (which is occaſioned by the Shadow of the Earth, that deprives it of the Sun's Light) ſhe was in great Danger, and laboured extremely hard, and imagined they could be of Service

to

to her by howling, rattling with their Timbrels, and making the moſt horrible Outcries and Noiſes they could poſſibly invent.

I find, ſaid the Marchioneſs, you begin to grow a little more moderate after this philoſophical Enthuſiaſm which had carried you ſo far, that you endeavour'd to reverſe the whole Order of Things. But you have now conſented to grant, that we think alike in theſe Opinions which you call ridiculous. As to all the reſt, I am very well ſatisfied, if you place this Difference of Ideas at ſo great a Diſtance as is between us and the Oriental Countries.

In order to make you ſtill eaſier, anſwered I, we will at preſent place theſe different Ways of Conception at a Diſtance ſtill greater, and in Proportion as you grow a greater Proficient in Philoſophy, we will bring them gradually nearer to us, till at laſt we will agree to put ſome Difference between your Ideas and mine, and from thence between the two Eyes of ſome Perſons to whom the ſame Object appears bigger

bigger when ſeen through one Eye, than it does when looked upon by the other.

How is this poſſible, ſaid the Marchioneſs? There is no End to your viſionary Fancies, and you ſeem reſolved to put me to the utmoſt Proof of my Credulity. Not contented to make a Difference of Ideas between different Perſons, you carry your Notions ſo far as to make this Difference between the two Eyes of the ſame Perſon. I muſt confeſs, I think this a very daring Way of proceeding. Did not *Gaſſendus*, (anſwered I) one of the celebrated Philoſophers of the laſt Age, affirm that he ſaw the Characters of a Book larger through one of his Eyes, than the other? You ſee the Fault is not to be thrown upon me, but upon the Eyes of *Gaſſendus*. You would find many other Perſons with theſe ſort of Eyes, if they were but as curious in examining their Senſes as they are diligent in making uſe of them. To ſome Perſons an Object is ſaid to appear green, when looked at through one

one Eye, and yellow or blue, when ſeen by the other. But do not we ſee every Day, that what one Perſon eſteems cold, another calls hot? Or rather do not we our ſelves think the ſame Thing to be cold or hot, according to our different Diſpoſitions? Would not the very ſame Thing that *Milo* might have thought ſmooth as a Mirror, appear rough as a Nettle to that luxurious Youth whoſe Bed was ſtrowed with Roſes, and who could not Sleep for a whole Night, becauſe a ſingle Leaf happened to be doubled? And do not theſe different Senſations which are ſo extremely oppoſite, as hot and cold, ſmooth and rough, proceed from a different Diſpoſition of the Senſitive Organs; from a different Affection of the Nerves, or the more or leſs delicate Texture of the Parts appointed to carry theſe Senſations to the Brain? And is it not very probable too, that theſe Differences may be in that Membrane of the Eye, upon which the Images of Objects are depictured, and in the Filaments of the Optic Nerve which tranſmit theſe Images

Images to the Brain? Hence it would follow, that as we receive different Senſations of hot, cold, ſmooth, and rough, we ſhould find the ſame Difference in our Senſations of Colours, and the like.

In order for me to enter into your Sentiments, ſaid the Marchioneſs, you muſt explain what you mean by ſaying that the Images of Objects are depictured upon the Membrane of the Eye; and that the Optic Nerve tranſmits thoſe Images to the Brain? Do you know, anſwered I, that an Explication of this will be no leſs than an Explication of a Viſion it ſelf? So much the better, ſaid ſhe: Indeed it ſeemed pretty ſtrange to me, that after you had ſpoke ſo much upon the different Ways in which it is poſſible for us to ſee, you ſhould be ſilent upon the Manner in which we really do ſee. I will not defer this Explication any longer, anſwered I, and I ſhall be extremely happy if my ſhewing you in what Manner you ſee me, may induce you to look upon me in a different

different Way from what you have hitherto done.

Light is principally ſubjected to the two Accidents of *Reflexion* and *Refraction*. *Reflexion*, according to the *Carteſians*, happens when by a Colliſion of the Globules of Light with the ſolid Parts of Bodies, theſe Globules are repelled back again juſt as a Ball rebounds when it is ſtruck againſt the Earth. And it is by this reflected Light, that we ſee all Bodies, the Moon, the Planets, Heavens and every Thing elſe, except the Sun, Stars, Fire, and all thoſe other Bodies here below, which ſhine by their own Light. *Refraction* is cauſed when the Globules of Light in paſſing through Air, Water, Glaſs, *&c.* meet with the Pores and Cavities of thoſe Bodies, ſo that the Ray, which is only a Chain or Series of Globules, breaks and is turned out of its proper Path, and takes a different Direction in its Paſſage from what it had before. Pellucid or tranſparent Bodies which ſuffer the Light to paſs through them, ſuch as Water, Air, Diamond, and Glaſs,

Glaſs, are called *Mediums*. Hence *Refraction* is ſaid to happen when the Light paſſes from one *Medium* to another And this *Refraction* is greater or leſs (that is, the Rays are more or leſs broken and turned aſide from their Path) in Proportion to the different Denſities of the *Mediums* through which the Light ſucceſſively paſſes. Thus for Example, the Rays are more broken in paſſing from Air into Glaſs, than in paſſing from Air to Water, becauſe Glaſs is much more denſe than Water, and for the ſame Reaſon they will be more broken in paſſing from Air to Diamond.

If this was a proper Time, (ſaid the Marchioneſs) to make Criticiſms upon Poets, it might be ſaid, that *Taſſo* has not expreſſed himſelf very accurately, when ſpeaking of *Armida*, he ſays,

As limpid Streams tranſmit the unbroken
Ray, &c.

Poetry in theſe Verſes, does not ſeem to agree with Optics, which will not allow that

that a Ray can be tranſmitted unbroken. *Taſſo* perhaps (anſwered I ſmiling) would be underſtood to ſpeak of thoſe Rays which fall perpendicularly upon Water or Cryſtal, that is, without being inclined, (with Regard to the Surfaces of thoſe *Mediums*) either to one Side or the other. As a Thread would fall upon the Ground if it had a Weight faſtned to it; for in this Caſe the Rays paſs on without being broken, and continue to proceed in the ſame Path as they firſt ſet out in: But the Truth is, that Poets do not addreſs themſelves to Philoſophers nor to you, who have nothing but *Refractions* in your Mind. But they write for the People, and conſequently muſt often make uſe of vulgar Prejudices and Opinions. And provided the Images be lively, the Paſſions ſtrong, and the Numbers harmonious, we may pardon them a Miſtake in Optics. What do you think of *Ovid*, who has perhaps ſtretched the poetic Licence too far, and made the Sun in a Day run through all the Signs of the *Zodiac*; whereas according to the exact Rules of Aſtronomy,

nomy, his diurnal Courſe is confined to about the thirtieth Part of only one Sign? In the ſecond Book of the *Æneis*, that Maſter-piece of ſublime Poetry, there is a very fine Image, which if examined by the Laws of Optics, would loſe all its Juſtneſs. *Æneas*, after he had been aſſured by *Hector* in a Dream of the irreparable Ruin of his Country, aſcends a Turret, and there diſcovers the Treachery of the *Greeks*, whoſe dreadful Effects appeared from every Quarter. The Palace of *Deiphobus* already levelled to the Ground, his next Neighbour *Ucalegon* on Fire, and the Flames of that City which a ten Years Siege had attacked in vain, dreadfully reflected by the Waves of the Sea. Now in the Situation in which *Æneas* ſtood this could not poſſibly be; for the Opticians will tell you, that in order for him to ſee the Flames of the City ſhine upon the Sea, the Sea muſt have been placed between him and thoſe Flames, which it was not. But who would not excuſe this Error, which can be ſeen only by a very few, for the ſake of

of thoſe fine Verſes which all the World admires?

But to return from Poetry to Phyſics, (a Tranſition which you have rendered very familiar to me) the manner in which the Rays of Light are broken in paſſing from a rare to a denſe *Medium*, as from Air to Glaſs, is different from what it is when they are tranſmitted from a Denſe to a rare *Medium*, as from Glaſs to Air. I would be underſtood, always to ſpeak of the Rays which fall upon theſe *Mediums* obliquely, and with ſome Inclination; for as I mentioned to you before, thoſe Rays which fall perpendicularly do not ſuffer any Deviation. If you ſuppoſe then, that a Ray of Light coming from the Air ſhould fall upon the Surface of a Glaſs, it will be broken in ſuch a Manner, that after its Trajection, it will be leſs inclined to the Surface of the Glaſs, and immerging will approach nearer a Perpendicular. After the ſame Manner a Ray of Light proceeding from your Eye, would ſtrike the Middle of this Baſon, provided it were dry. But ſuppoſing it filled with Water,

Water, as it now is, the Ray could not continue its Courſe directly to that Point as at firſt, but in its Tranſmiſſion thro' the Water would be bent in ſuch a Manner that it would fall on one Side, and ſtrike the Baſon in a Point nearer to us. Theſe are all the Lines and Figures that I will draw you, to explain the preſent Subject.

What need is there of Lines and Figures, replied the Marchioneſs, to underſtand that a Ray of Light paſſing from Air into Water or Glaſs, will be bent in going towards it, and approach nearer to a Perpendicular? And does not the contrary happen, when the Ray paſſes from Glaſs into Air? Yes certainly, anſwered I; the Ray in this Caſe is more inclined after its Trajection to the Surface of the Air, (which immediately touches the Glaſs) it becomes more unlike a Perpendicular, and places it ſelf as it were behind the Surface of the Air.

Theſe *Refractions* of the Rays of Light which were known though very imperfectly to the Antients, and to the

Conſideration of which we in great Meaſure owe the Perfection of Aſtronomy, are the Cauſe of an infinite Number of ſtrange and amuſing Phænomena, which we every Day obſerve; ſuch as Objects appearing out of their Place when viewed through a *Priſm*. An Oar broken in the Water, and the Surprize of ſeeing our ſelves deformed and crooked when in a Bath.—— This is the very Thing, ſaid ſhe, interrupting me, that I lately obſerved when I was in the Bath, and I was extremely ſurprized and puzzled to find out the Reaſon of it. It is nothing elſe, anſwer'd I, but the *Refraction* which the Rays ſuffer in paſſing from Air into Water. Theſe *Refractions*, beſides what we have already mentioned, are the Cauſe too why we ſee the Bottom of Veſſels and Rivers much ~~deeper~~ than they really are, and that Sailors after a long and tedious Voyage, have the Pleaſure of ſeeing and ſaluting the Land, much ſooner than they would otherwiſe do. This too is the Reaſon that the Sun and Full Moon appear to our Sight of an

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oval Figure when near the Horizon, and many other Things of the like Nature, which proceed from hence, that the Rays in their Paſſage from theſe Objects to our Eyes are refracted, and come from Places different from thoſe where the Objects themſelves are. The Eye which is not ſenſible of theſe *Refractions*, always refers and tranſports the Objects to thoſe Places from whence the Rays appear to proceed, or in other Words, it ſees them in the Direction of the Rays which penetrate and ſtrike it. Hence it is, that the Figure and Situation of Things which are ſeen by refracted Rays, come to be changed. If, without knowing any Thing of the Science of Optics, the firſt Time I had the Honour of ſeeing you, a *Priſm* had been placed before my Eyes, which by *refracting* the Rays which proceed from you to me, had given them the ſame Direction which they would have had if they had come from the Sky, you would certainly have appeared to me to have been tranſported into the World of Chimeras, and incompaſs'd with

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an infinite Variety of Colours, and I ſhould have intreated you to deſcend, as *Endymion* did the Moon, and addreſſed my ſelf to you in ſome florid Deſcription of a ſhady Grove or lonely Vale, in order to tempt you from the Stars. And all this fine Deluſion would have been occaſioned by that Direction which the *Priſm* had given to the Rays, which would have flowed from you to my Eyes.

I fancy, ſaid the Marchioneſs, that Mankind always look upon thoſe, who are in a Condition much ſuperior to their own, through certain *Priſms*, which make them appear as if they were tranſported to Heaven, to revel upon Ambroſia, enjoy the Converſation of the Gods, and be ſurrounded with Glory and Happineſs; whereas the more they are elevated above others upon Earth, the more ſubject are they to the Sport and Caprice of Fortune. This Compariſon will appear ſtill juſter, anſwered I, upon this Account, that as when we quit the *Priſm*, we ſee the Objects again return to their proper

Place: So when we forſake the Opinions of the Vulgar, and ſubſtitute thoſe of good Senſe in their Room, theſe Demi-gods appear nothing more than other Men, and in a Condition not greatly to be envied. But to return to our Subject: A philoſophical Eye every Day diſcovers an infinite Number of ſtrange and diverting Phænomena ariſing from the Change of Direction produced in the Rays of Light, not only by *Refractions* but by *Reflexion* too. From hence proceed all the Wonders of Concave Glaſſes, by the Help of which that Poet, who wrote a Diſſertation on the Nature of Bees, could diſcern the ſmall Members and diminutive Parts of that noble and induſtrious Inſect, and magnified them to that Degree that each of *them ſeemed as big as a Dragon.* With theſe Glaſſes too the Veſtals rekindled their ſacred Fire, whenever it happened to be extinguiſhed. From hence aroſe the Fables of *Archimedes* and *Proclus*, and Ignorance and Impoſture have rendered theſe Glaſſes one of the Favourite Inſtruments

ments of Magic. But among the Phænomena which ariſe from a Change made by Reflexion in the Rays of Light, you will perhaps be ſurprized to find one which is every Day preſent with you, and which perhaps you have never yet conſidered as a Phænomenon, much leſs a Matter of Wonder. What Phænomenon can this be, ſaid the Marchioneſs, to which I have paid ſo little Regard? It is, anſwered I, the Image of your ſelf which appears beyond the Looking-glaſs every Morning, when you hold a Conſultation with the Graces in what Manner it will be beſt to give an artificial Negligence to your Hair. This Repreſentation of your ſelf proceeds from hence, that all the Rays which flow from all the Points of your Face to the Looking-glaſs, are reflected in ſuch a manner to your Eye, as if they proceeded from as many other Points as there are in your Face equi-diſtant from each other, and as far beyond the Glaſs, as you are of this Side of it; and conſequently you ſee your Image at as great

a Diſtance from the Glaſs, as you your ſelf are, and exactly like you; and from the Pleaſure this beauteous Repreſentation affords you, you eaſily conceive what Pleaſure the Original muſt give to others. The celebrated *Milton* has in his ſublime Poem finely deſcribed the Delight and Surprize of *Eve* the firſt Time ſhe ſurveyed herſelf in a Fountain,

——That ſtood unmov'd
Pure as the Expanſe of Heav'n—.

And this Image of herſelf appeared ſo charming, that, like another *Narciſſus*, ſhe afterwards ingenuouſly confeſſed to *Adam*, that though ſhe thought him fair, yet he ſeemed,

——leſs fair
Leſs winning ſoft, leſs amiably mild,
Than that ſmooth wat'ry Image——

Does not this Paſſage of *Milton* convey ſome malicious Inſinuation, ſaid the Marchioneſs? And is not his real Mean-

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ing that the Sight of a Husband gives a Woman leſs Pleaſure than even an Image or a Shadow? However I agree, that our firſt Parent was in the right to admire this fine Phænomenon, and I have been greatly to blame in my Neglect of it; but we are too early accuſtomed to the Sight of theſe Things, for them to make a ſtrong Impreſſion upon us. If any one had told me a few Days ago, that certain Rays flowing from my Face, would have been reflected from the Looking-glaſs, I ſhould have believed it to be one of thoſe uſual Enigma's which Gallantry borrows from Tradition, or founded upon the Authority of ſome old Romance. But I confeſs that from this Time, I ſhall ſurvey myſelf in the Glaſs with a ſort of philoſophical Pleaſure.

There is no greater Pleaſure, continued I, to Philoſophers, than that of obſerving the various Sportings of the Rays of Light, in paſſing through a *gibbous* Glaſs, or one that is convex on both Sides, and which from its Reſemblance to a Grain of *Lentille*, is

termed a *Lens*. And upon this depends the Explanation of Viſion. If two Rays of Light mutually *parallel*, (that is to ſay, which always keep the ſame Diſtance from each other without approaching nearer or removing farther off, like the Eſpaliers of theſe Walks) fall upon a *Lens*, by Means of that *Refraction* which they ſuffer, they are united beyond it, into one Point that is called the *Focus of the Lens*, which is more or leſs diſtant in Proportion as the *Lens* is more or leſs convex. So that the greater the Convexity, the leſs will be the Diſtance of the *Focus*, and the leſs the Convexity is, the Diſtance of the *Focus* will be the greater. And this Diſtance of the *Focus* is what diſtinguiſhes the *Lens*: As for Inſtance, we ſay this *Lens* has ſo many Feet of *Focus*, and another ſo many, juſt as we ſay ſuch a Machine can raiſe the Water to ſuch a Height, by which we would ſignify the Force and Activity of it. I fancy, ſaid the Marchioneſs, that the Reaſon why this Point is called a *Focus*, is becauſe a Candle may be

ſet

ſet on Fire when placed there, as I once ſaw done by a Perſon who undertook to light a Candle without the help of Fire by the Sun. He might ſafely have engaged, anſwered I, to light the Candle not only without Fire, but even with Ice. For a *Lens* made of Ice in a little Space of Time produces the ſame Effect as one that is formed of Glaſs. How many Impertinences might this have furniſhed the Poets with in that Time when their Language was,

See guarded by the watchful Powers of Love,
Fair Delia *ſlumbers in the peaceful Grove;*
Struck with the Sight, let wond'ring Mortals own,
Amidſt the gloomy Shades, a Radiant Sun!

But the Reaſon that you give is a very good one: The burning which follows in that Point where the *Lens* unites the Rays which were at firſt parallel, and forms them into a Flame, is the very Reaſon why it is called the

Focus. All the Rays, which are not mutually parallel, but in going from a Point keep continually removing from each other, and which are called *diverging* Rays, unite beyond the *Lens* in another Point, which is always more diſtant than the *Focus* of the *Lens* itſelf. Hence we ſay, that a convex *Lens* renders the Parallel and diverging Rays converging. For thoſe Rays are called *converging*, which proceeding from various Parts, have a Tendency to unite themſelves in one Point. Juſt as the Alleys of thoſe Woods which are formed in the ſhape of Stars, continually approach to one another till they all meet in the Centre. Theſe Walks, ſaid the Marchioneſs, interrupting me, might be called diverging, with regard to one in the Centre of the Wood, from whence they proceed, always removing ſtill farther from one another. You only want, *Madam*, anſwered I, to turn over *Euclid* and *Apollonius* a little, and ſometimes put on an abſtracted Look, and you will be a complete Geometrician.

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But to follow the Track of theſe Rays as we have begun —— the more that Point, from which the diverging Rays ſet out, is diſtant from the *Lens*, the nearer the *Lens* and its *Focus* is that Point where theſe Rays unite; and ſo on the contrary the nearer that Point from whence the diverging Rays proceed is to the *Lens*, the farther off from it and its *Focus* is that Point where they unite; provided however, that the Point from whence theſe Rays proceed be not at ſuch a Diſtance, that inſtead of uniting they are thrown out of the Glaſs either diverging or parallel. Opticians in order to find out the innumerable Variations which theſe Rays may form, make uſe of a certain Science called *Algebra*, which after having extended its Empire over all the Regions of natural Philoſophy, has ſince by the ingenious Contrivance of Intereſt been appropriated to civil Uſes, to determine the Chances of thoſe Games which are the moſt ſubject to the Caprices of Fortune, and has even inſinuated itſelf into the litigious Provinces of Law and

Morality. By the help of this Science, they have always certain Letters at Hand, called Symbols, connected with each other by certain Signs: With theſe, provided they know the Quality of the *Lens*, that is the Diſtance of its *Focus* and of the Point from whence the Rays proceed which fall upon the *Lens*, or the Diſtance of the Point to which the Rays tend if they ſhould fall converging upon the *Lens*, Opticians can tell you in a Moment, whether the Rays will unite or not, whether they will go out of the *Lens* diverging or parallel, and in what Point they will unite. This looks like a Species of Magic, which perhaps would not have eſcaped unpuniſhed in that Age, when it was a Crime to aſſert the Motion of the Earth and the Exiſtence of the *Antipodes*.

The Uniting of the Rays diverging from ſeveral Points, into the like Number of Points beyond the *Lens*, which ſeems in itſelf a very indifferent Thing, ſupplies us with one of the fineſt Sights

you

you can poſſibly imagine. If to a Hole made in the Window-ſhut of a darkned Room, you apply a *Lens*, and over-againſt this at a proper Diſtance there be placed a Sheet of white Paper, you will ſee all the Objects which are without the Window (eſpecially thoſe which are directly oppoſite to the *Lens*) inverted and painted upon the Paper with a Beauty, Vivacity and Softneſs of Colours that would make a Landſkip drawn by *Claude Lorrain*, or a Viſto by *Canalleto*, appear faint and languid. You will perceive the Diſtance of the Objects exactly the ſame as you would do in a Picture that is the Smalneſs of thoſe Objects which are far off from a little Confuſion and Obſcurity, from a certain Faintneſs of the Colours, and in ſhort, from a moſt exact Perſpective the grand Secret of that happy Art of Deluſion, Painting, which accompanies and aſſiſts all I have been deſcribing. It is impoſſible to expreſs to you the Pleaſure that reſults from the Motion and Life which animates this fine Piece: The Trees

are really agitated by the Wind, and their Shadow follows the Motion. The Flocks bound upon the Lawns, the Shepherd really walks, and the Sun Beams play upon the Waters. Nature draws her own Picture inverted and in Miniature.

It is pity, ſaid the Marchioneſs, that ſo fine a Picture drawn by the Hand of ſo excellent a Maſter, ſhould be turned upſide down, which I am as much at a Loſsto find the Reaſon of, as I am of the Manner in which it is form'd. Let us ſuppoſe, anſwered I, without Side of the Window over-againſt the *Lens* an Arrow to be placed horizontally, that is, even with the Bottom of the Window: Let the Point of this Arrow be on the Right-hand, and the Feathers on the Left. Suppoſe too that the Extremity of the Point emits Rays upon the *Lens* which intirely cover it. Theſe Rays unite beyond the *Lens* itſelf in another Point, but in paſſing through the *Lens*, inſtead of being on the Right-hand as they were at firſt (as proceeding from the Point of the Arrow which

we ſuppoſed to be on the Right-hand) they change their Situation, and are placed on the Left. In the ſame Manner the extreme Point of the Feathers throws Rays upon the *Lens* which unite in another Point, and after their Paſſage through the *Lens* are turned from the Left to the Right-hand. Juſt in the ſame Manner as if a Perſon held two Sticks, one in each Hand, and ſhould croſs them together; that which before the croſſing was on the Right will afterwards be on the Left-hand, and on the contrary that which was on the Left will be on the Right. Now the Rays that fall upon the *Lens* croſs each other, juſt as theſe two Sticks do in the Point where they touch. The ſame may be ſaid, if the Arrow ſhould be ſet upright. Thoſe Rays which proceed from the Top of it, after being croſſed and paſſing through the *Lens* remain at Bottom, and thoſe which came from the Bottom at Top. Thus you ſee the whole Situation of the Rays is changed. That which was at Top is placed at Bottom,

Bottom, and what was at Bottom, appears at Top. That on the Right-hand is turned to the Left, and that on the Left to the Right. If a Sheet of Paper be then placed behind the *Lens* in the Place where theſe Rays unite, they will draw you an Image of the Arrow in which the Point ſhall be on the Left-hand, and the Feathers on the Right, or in other Words, the Image will be the reverſe of the Object. You may eaſily transfer what I have ſaid of the Arrow, to a Landſkip, a Piazza or any other Object, with this Difference however, that all the Parts of a Landſkip or Piazza cannot be equally diſtinct in the Picture as thoſe of the Arrow are, becauſe the Rays unite at different Diſtances from the *Lens*, in Proportion to the different Diſtance of the Points from whence they flow. If, for Inſtance, an Object in the middle of this Walk is ſeen diſtinctly upon the Picture, as it will be if the Paper be ſet in a Place where the Rays which come from it unite, thoſe Objects which are nearer cannot be diſtinct, becauſe the Point

Point where their Rays unite is at a greater Diſtance; neither will thoſe Objects which are farther off be diſtinct, becauſe the Point where their Rays unite is nearer the *Lens*, and conſequently the Rays, as well of the one as the other, fall upon the Paper disjoined, and only form an Image there which will be very dim and languid, or in other Words confuſed; ſo that for thoſe Objects which are far off, we muſt place the Paper nearer the *Lens*, and ſet it at a greater Diſtance when we would ſee thoſe which are near.

It will now be neceſſary, ſaid the Marchioneſs, that you ſhould provide your ſelf with a *Lens*, and give me a Sight of theſe fine Landſkips all round us upon a Sheet of Paper. For I muſt confeſs, I have a great Curioſity for this, both as a Woman, and as a Woman whom you have rendered half a Philoſopher. I wiſh, anſwered I, that I had one with me to ſatisfy your Curioſity this Moment, which by what you ſay muſt be extremely ſtrong. But I will

will ſatisfie you as ſoon as I am able with a View of this *Camera Obſcura*. But what will you imagine if I ſay to you when we are in it, ſuppoſe your ſelf to be placed in one of your Eyes, and to ſee every Thing that paſſes there?

The *Camera Obſcura*, repreſents the Inſide of our Eye, which is nearly of the Shape of a Ball: The Hole in the Window is the Pupil which is in the Fore-part of the Eye, and appears in all as a dark Hole, ſometimes greater, ſometimes leſs. The *Lens* is the Cryſtalline Humour which is exactly of that Figure, and is placed over-againſt the Pupil, and ſuſpended by certain little Fibres called the Ciliar Proceſſes, which proceeding from a Coat or very thin Skin which incompaſſes the Inſide of the Eye, are fixed in the Edge of it: The Paper on which the Image of Objects is depictured, is the *Retina*, compoſed of the Filaments and Medullary Subſtance of the Optic Nerve, which is faſtned to the Eye behind, and is the great Channel of Communi-

cation

cation between that and the Brain. The Spaces which are between the Fore-part of the Eye and the Cryſtalline Humour, and between this and the *Retina* are filled with two Humours leſs denſe than the Cryſtalline, but denſer than the Air. By the Help of all this *Apparatus*, external Objects are pictured upon the *Retina* in Miniature juſt as in the *Camera Obſcura*, and thus we ſee.

Really I did not think, ſaid the Marchioneſs, that I ſhould be tranſported thus in an Inſtant from the *Camera Obſcura*, to the Inſide of my Eye, nor that the fine Picture, you before deſcribed, had ſo much Relation to Viſion. Many muſt have obſerved this, anſwered I, before you, without ſuſpecting any ſuch Relation. If there be a Hole made in any Room which is otherwiſe dark, and this Hole does not exceed a certain Bigneſs, this will be ſufficient to ſhew you thoſe Objects which are over-againſt the Hole, painted upon the oppoſite Wall or the Floor of the Chamber. Is there no need of the

Lens

Lens then, ſaid the Marchioneſs, in order to the Production of this Picture? It is neceſſary, anſwered I, to give it in ſome Meaſure the finiſhing Stroke. But even without the *Lens* if the Hole be ſmall enough, and the oppoſite Wall or the Floor not very diſtant, the Rays which paſs through the Hole are near enough not to appear confuſed, and may draw a tolerable Picture of the External Objects upon the Wall or the Floor.

If the Cryſtalline Humour becomes opaque, which is what forms a Cataract, there is no other Remedy in this Caſe to recover the Sight, than by depreſſing the Cryſtalline Humour and cutting away the Fibres which hold it ſuſpended, and then ſome faint Repreſentation of the Objects may be drawn on the *Retina* of thoſe unhappy Perſons. But as the Picture in the dark Room is much weaker and more confuſed if there be not a *Lens* applied to the Hole, ſo is that which is made upon the *Retina* of theſe Perſons, when the Cryſtalline Humour which is the

Lens

Lens of the Eye is no longer fixed over-againſt the Pupil. It is true, thoſe two Humours which remain (the glaſſy and aqueous) help the Rays to unite, and a Convex-glaſs may in ſome Meaſure ſupply the Defect of the Cryſtalline Humour. It would be well if this Convex-glaſs could aſſiſt the Eyes under a much more terrible Diſtemper in which though they ſeem well and ſound, the *Retina* or the Optic Nerve being weakned and obſtructed cannot tranſmit any Senſation to the Brain of the Images of Objects, though they are clearly and diſtinctly drawn upon it. This Diſtemper, which is called a *Gutta Serena*, occaſioned the Blindneſs, if not of the *Greek* at leaſt of the *Britiſh Homer*, which he interweaves in his Poem among the Beauties of *Paradiſe Loſt*, the Battles of Angels, and the pregnant Abyſs.

This Picture then of the *Camera Obſcura*, ſaid the Marchioneſs, which ſeemed of no other uſe than to imploy idle People, or ſuch as have a Taſte for Painting, is in Reality of very great Service

Service to us, and in ſome Caſes even reſtores Sight to the Blind. Are we not obliged to *Des Cartes* for having rendered it ſo uſeful to us? *Des Cartes*, anſwered I, is very happy, to whom you would willingly be obliged for every Thing. But in this Caſe your Acknowledgments are due to an induſtrious *German*, who laid the Foundation of many Things which others have ſince brought to Perfection. He was the firſt who gave us a true Explication of Viſion, which has always been a Subject of Speculation among Philoſophers; and conſequently has had its ſhare of ridiculous Notions. For ſome among the Ancients ſuppoſed certain Rays which extending themſelves from the Inſide of the Eye to its Superficies, preſſed the Air as far as the Object to be ſeen, and this Air finding ſome Reſiſtance from the Object, made it perceptible to the Sight, others affirmed that Viſion was form'd by the Reflexion of the Sight; that is, becauſe Rays flowed from the Eye to the Object, and were from thence reflect-

ed

ed back to the Eye; ſo that theſe gave it an exact Information what the Object was. Nor were there wanting ſome who affirmed that certain Effluvia go from the Eye, and meeting in their Way with other Effluvia of Bodies, they link themſelves with theſe, and turning back again with them to the Eye, give the Soul a Perception of Objects. And the moſt rational among them aſſerted that extremely fine Membranes formed of Particles and Atoms are thrown off from the Surfaces of Bodies, and have mutually the ſame Diſpoſition and Order, as there is in the Surfaces of the Bodies themſelves from whence they proceed, and that theſe Membranes, which they call *Simulachra* or Images exactly reſembling the Bodies from whence they are ſent, enter into the Eye, and this is the Cauſe of our ſeeing. And it is ſurprizing to think that in ſuch an Age as this, ſuch a Country as *England*, there ſhould be found any Perſon [a] who ſhutting his Eyes

[a] Dr. *Robert Green*, Fellow of *Clare-hall, Cambridge*

Eyes againſt the Light of Things, would be again immerſed in the profound Darkneſs of unintelligible Words, and aſſert that Viſion is formed by Means of the different Degrees of the expanſive Force communicated from Bodies to the Eye, through a *Plenum*, and that the different Modifications of it, as Clearneſs, Weakneſs, and Confu-

bridge, publiſhed in 1712. a Book intitled the *Principles of Natural Philoſophy*, in which is ſhewn *the Inſufficiency of the preſent Syſtems to give us any juſt Account of that Science, and the Neceſſity there is of ſome new Principles in order to furniſh us with a true and real Knowledge of Nature*. In this Book he undertakes to ſhew the Unreaſonableneſs of the greateſt part of that Philoſophy hitherto received under the Name of the *Corpuſcularian*, and then proceeds to lay down the Principles upon which alone he thinks it poſſible for Nature to be explained. He farther endeavours to evince the Incompetency of the preſent Mathematics to furniſh us with any juſt or adequate Reaſonings upon Nature, and the Neceſſity there is of ſome new Principles in that Science, which he has in ſome Meaſure explained in the *Geometria Solidorum* annexed to this Book, and from which he has been long aſſured that the ſquaring of the Circle is not impoſſible. —— The celebrated Mr. *Cotes* Profeſſor of Aſtronomy uſed to ſay that this Book ſhewed the Author to have had as extraordinary a Genius as Sir *Iſaac Newton*'s, ſince it muſt have been the Effect of Deſign to guard ſo effectually as he did againſt ſaying any one right Thing throughout ſo large a Treatiſe.

ſion

ſion in the Sight, ariſe from the Proportion which theſe expanſive Forces have with the contractile one's of the Optic Nerves. However, all the Moderns except this (who like him that wrote in theſe latter Ages againſt the Circulation of the Blood was neceſſary to give us a Specimen of the infinite Varieties and Extravagancies of the human Mind) have rejected theſe chimerical Explications, the Offspring of Pride and Ignorance; neither have they greatly eſteemed the Reaſonings of thoſe who thought that the Effluvia proceeded rather from the Eye, than from the Objects; ſince it was more reaſonable they ſhould proceed from an animate than an inanimate Subſtance; that the Ears, the Mouth, and the Noſe, were made concave to take theſe Effluvia in, whereas the Eye was made convex, and therefore proper to ſend them out. Notwithſtanding all theſe fine Reaſons, Opticians have reduced the Eye to a perfect *Camera Obſcura*, rejecting and extinguiſhing that Light which the greater Part of the Ancients ſuppoſed to proceed

ceed from it. Indeed the auguſt Eyes of *Tiberius* muſt perhaps be excepted, who, as 'tis ſaid, when he waked in the Night, could for ſometime ſee as well as in clear Day-light, which is ſaid to ariſe from his emitting certain Sparks from them. You may ſay the ſame of any other Perſon, who is conſiderable enough to deſerve that an Exception ſhould be made in his Favour.

It will be neceſſary for us, ſaid the Marchioneſs, to look upon Cats as conſiderable Perſons, and make an Exception in their Favour too. We ſhall willingly grant them that Honour, anſwered I, only they muſt not take it ill if we ſay that the Light which ſeems to proceed from their Eyes in the Dark, ſerve only to give Light to Objects, and by this Means the Image may be drawn upon their *Retina*: For Viſion, as well as innumerable other Things, is performed in the ſame Manner in Men as in Brutes; or rather we may acknowledge ourſelves obliged to thoſe for that Evidence which we have of the Manner of its Operation: For in

in order to demonſtrate it, we make uſe of the Eye of an Ox, or ſome other Animal, at the Bottom of which when the Coats are taken away, if we place a very thin and tranſparent Paper, we ſhall ſee the Image of thoſe Objects to which the Eye is turned drawn upon it and inverted, juſt the ſame as in a *Camera Obſcura*.

This ſhews how very capricious our Senſes are. For Inſtance, we ſay that there is Heat in the Fire no leſs than in our Hands. Thus we confound one Motion which is in the Fire, and another that it raiſes in our Hands, with the Senſation of Heat, which Senſation is neither in the former nor latter. But we do not ſay that Colour is in our Eye as it is in Objects, though without Diſpute the Colours raiſe ſome Vibration and Motion upon the *Retina*. and are painted upon it as ſtrong and lively as they are upon the Objects themſelves. Thus we confound two Things in the Perception of Heat, and only one in that of Colours.

It appears, ſaid the Marchioneſs, that we are much obliged to our Senſes in this Point, for exempting us from one Illuſion at leaſt. But do not they amply repay themſelves by thoſe many others to which they have ſubjected our Sight? We ſee only one Object, though it be looked at with both Eyes, and ſee it upright, though it be drawn inverted upon the Eye. You are a little too much prejudiced againſt the Senſes, anſwered I, and I muſt for this Time undertake their Defence. Is not the Reaſon of all this Violence which you expreſs againſt Viſion, becauſe you had not the Explanation of it from *Des Cartes?* Defend it, if you pleaſe, ſaid ſhe, without accuſing me, and reſcue it, if you can, from the Charge of theſe two Illuſions which I allege againſt it. Would they not rather be Illuſions, anſwered I, if we were to ſee an Object double which we know to be ſingle, and that to be inverted which we know to be direct? To-morrow we will enter upon a Diſcuſſion of theſe two Points, which *Huygens*, one of the great Promoters

moters of Knowledge in the laſt Age, thought beyond the Reach of human Underſtanding. To-morrow perhaps you may know more than that great Man, but it is impoſſible for *that* Acquiſition to render you more charming than you are to Day.

DIALOGUE *the* THIRD.

Several Particulars relating to Viſion, Diſcoveries in Optics, and a Confutation of the Carteſian Syſtem.

THE Marchioneſs felt the utmoſt Impatience to be more learned than *Huygens*. She was not for loſing a Moment's Time, but would have continued our Diſcourſes upon Viſion the next Morning as ſoon as ever we were up. I told her that we muſt prepare ourſelves with ſomewhat more Ceremony for ſo high a Degree of Knowledge, and that it well deſerved that we ſhould at leaſt wait till after Dinner. In the Interim not to loſe Time, that we might learn how it comes to paſs that the Eye ſees the Objects which are without it, but cannot at all ſee itſelf. A

from hence ſhe might form a clearer Idea of certain Verſes which no doubt muſt have been often addreſſed to her.

This was all the Optics ſhe could get from me in the Morning. She waited for the Afternoon with as much Impatience as an Initiate full of the Expectation of being let into ſome profound Myſtery. In order to underſtand why we ſee only one Object with two Eyes, would you be pleaſed, *Madam*, (ſaid I) if I ſhould tell you that in Reality we ſee only with one Eye, and that the other remains idle and at reſt? You had better, ſaid ſhe, at once reduce us to a ſingle Eye, and then you will have no farther Difficulty. I ſhould be as well pleaſed if you was to ſay that we walk only with one Leg. You are more moderate, anſwered I, than a *Latin* Poet, who ſays that Women would be as ill-pleaſed to have but one Lover, as but one Eye. But this ſtrange Explication however was given by a grave Philoſopher, and reſembles the Pride of the *Chineſe*, (who fancy that all Nations except their own ſee with but one

Eye) ſince both the one and the other are equally the Offspring of Ignorance. But this may ſerve to let you ſee what Difficulties there are in ſolving the Queſtion we are now upon. Another made the Optic Nerves to reſemble two Lutes compoſed of various Strings, which have an exact Correſpondence with each other, ſo that the two Images of the Object falling upon Strings wound up of an equal Height or a Uniſon, the Object muſt appear ſingle; but all theſe fine and ingenious Explications will not make you a better Philoſopher than *Huygens*. I believe that the true Explanation of this difficult Phænomenon, like many others in Viſion, depends upon Experiments. The Senſes of Feeling and Sight lend each other a mutual Aſſiſtance in the Formation of our Ideas, juſt as our Eyes and Ears help each other when we learn a new Language. The Senſe of feeling, which is much ſtronger than the Sight, has conſtantly informed us that in the ordinary way of ſeeing the Object is but one, and by a long Habitude we join the

Idea

Idea of one ſingle Object with the two Senſations of it. In the ſame Manner an Object that is felt with two Hands or two Fingers at a Time, notwithſtanding the two Senſations which we have of it, ſeems to be only one, and this is occaſioned by thoſe other Ideas which we had conceived of it when we touched it only with one Hand or one Finger. If a Button or a Ball of Wax be preſſed with two Fingers at a Time in an unuſual Manner, by croſſing the Fingers together, it will appear double, juſt as Objects do when we ſquint upon them. In both Caſes the antecedent Ideas of feeling are not ſo ſtrongly united by a long Habitude with theſe unuſual Senſations, as to make us join them with the Idea of one ſingle Object.

Do you believe then (ſaid the Marchioneſs with an Air of Surprize) that if a Perſon had been long accuſtomed to preſs a Button with two Fingers croſſed together, he would no longer feel it double? No certainly, anſwered I, for the very ſame Reaſon that Ob-

jects do not appear double to Perſons who are naturally ſquint-eyed. Theſe by a long uſe acquire the ſame Habit in their manner of ſeeing as we do in ours. We have a very ſingular and curious Obſervation to this Purpoſe, upon a Perſon who by ſome Misfortune had diſtorted and diſlocated one of his Eyes. At firſt all Objects appeared double to him, till at Length by little and little thoſe which were the moſt familiar to him, (that is, thoſe which he had the moſt Experience of by feeling,) became ſingle, and in Time all the reſt, though the Diſlocation ſtill continued. I may venture to affirm that by Virtue of this Experience, *Argos* with all his hundred Eyes did not ſee the fine Heifer committed to his Charge by the jealous *Juno*, at all more multiplied than *Polipheme* did his *Galatea* with only one Eye.

You ſeem to exult mightily, ſaid the Marchioneſs, in this Experience which we gain from our Touch, will it give you Confidence enough to undertake by its Aſſiſtance the Solution of that Queſtion

Queſtion I propoſed to you yeſterday: How it comes to paſs that Objects, which are drawn inverted upon the Eye, appear direct in the Mind? Theſe Experiments, anſwered I, extend farther than you perhaps imagine, and the Ideas of Sight conſidered with Regard to thoſe which we receive from Touch, are no more than four Strokes of a Pen compared to a fine *Relief*. We have the Example of a Statuary, who tho' he was blind, yet by the Help of his Feeling made tolerably good Likeneſſes: One of the greateſt Mathematicians in *England*, (that Land of Phænomena) and who could give you a much better Explanation of Optics than I can, was yet deprived of his Sight ſo young, that he may be affirmed to have been born blind. This Perſon is certainly much more wonderful than that learned *Frenchman*, who without either Voice or Ear, undertook to learn Muſic, and very much improved the greateſt and moſt curious Myſteries in that Art. Feeling furniſhes the Imagination of this great Philoſopher with much clearer

and more diſtinct Ideas, than others receive from Sight. What a Pleaſure would he have in making uſe of your fine Fingers to explain the converging and diverging of the Rays? On the other Hand what could we learn, or what could we do without our Feeling? We ſhould be incapable to judge of the Situation, Diſtance or Figure of Objects, as *Berkley* had propheſied, who perhaps conſidered the Metaphyſics of Viſion more than any one ever did; and Experience has verified this in ſome Perſons, who, after being cured of Cataracts born with them, could not form any Judgment till the Touch lent them its Aſſiſtance; without this our Eyes would continually tantalize us with a View of Knowledge and Pleaſure which we could never enjoy. The daily Experiments then, that we make with our Feeling, inform us that Objects are direct, (in the ſame Manner as they teach us they are ſingle) that they are placed in certain Situations, at certain Diſtances, and of certain Figures. I believe *Des Cartes* is the only one who ever

ever pretended to give an immediate Explication of this difficult Phænomenon by a Similitude. Suppoſe yourſelf, ſaid he, to have two Sticks acroſs each other, one in your Right, and the other in the Left-hand, and to walk with your Eyes ſhut about a Room with theſe Sticks before you. There is no Queſtion but you will think thoſe Things which you touch with the Stick in your Right-hand, and which by this Means will make a Preſſure upon that Hand, to be on your Left; and in like manner whatever you touch with the other Stick in your Left-hand, you will affirm to be on the Right. After the ſame manner the Rays which proceed from Objects to the bottom of the Eye, croſſing each other in the Cryſtalline Humour, thoſe which preſs the *Retina* on the right Side will make you refer thoſe Points from whence they proceed to the left Side, and thoſe Rays which preſs it on the Left you will refer to the right Side; and thus thoſe Rays which preſs upon the upper Parts of the *Retina*, will

make you refer the Points from whence they proceed to the lower Part, and thoſe of the lower to the upper. And by this Means the Image, which is inverted upon the *Retina*, makes you ſee the Objects direct.

Indeed, ſaid the Marchioneſs, this is very ingenious; why may not we confine ourſelves to this without ſeeking any other, ſince it gives us an immediate Explication of our Phænomenon? Experience, anſwered I, unhappily informs us, that this is not an ingenious Explication: A Boy who ſtands upon his Head ſees every Thing inverted, notwithſtanding the Images of external Objects are pictured upon his *Retina*, in the very ſame manner when he is in this Situation as they are when he ſtands upon his Feet. He has no other Idea of high and low, than what regards his own Situation; and when he is in this inverted Poſition, he imagines the whole Univerſe to be ſo too. Beſides, the Explication of *Des Cartes* ſuppoſes the Ideas of high and low, Right and Left, which we can only have from Feeling, to be antecedent. It

It is our Feeling, which by an Experiment every Moment repeated has conſtantly taught us to call the Earth, towards which we find ourſelves continually carried by Gravity, *low*, thoſe Things which are contiguous to the Earth, as the Pedeſtal of a Pillar or our Feet, *below*, and thoſe Things which are diſtant from the Earth *above*, as our Head or the Top of a Tree. The Senſe of Feeling conveys theſe and the like Ideas into the Soul of a Man born blind, with as much Exactneſs as that of Sight does the Ideas of Colour into ours. Now, if we ſuppoſe that Vail which hides the viſible World from his Sight, to be taken away all at once, and conſider in what manner he would judge of the Situations of Objects, we might from thence arrive to a clear Knowledge of the Manner in which we ourſelves judge of them, ſince we have the Ideas of high and low in common with him; he would certainly be more ſurprized at firſt opening his Eyes, than the famous [a] *Epimenides*

[a] A *Cretan* Philoſopher when he was a Boy, being ſent

menides was after his long Sleep of ſo many Years, who remembered nothing which he ſaw about him when he waked, not even the Place where he had been born and brought up. A new Scene of Ideas diſplays itſelf to him, a Torrent of new Perceptions ruſh upon him through this new Avenue by which Objects enter the Soul. Amazed and overwhelmed with them, he finds himſelf tranſported, without knowing how, into another World. What a Pleaſure, what an Extaſy muſt this be! ſaid the Marchioneſs? If Novelty which always hovers about theſe Things of which we

ſent by his Father into the Country to fetch a Sheep, he turned out of the Road at Noon and repoſed himſelf in a Cave, where he ſlept 57 Years. After this Refreſhment he awaked and looked about for the Sheep (imagining he had ſlept but a little while) not finding it, he proceeded to his Father's Country Eſtate, where he ſaw every Thing altered and in Poſſeſſion of another. He then returned to the City, and went to his Father's Houſe, where his younger Brother now grown an old Man, at laſt knew him, and gave him an Account of all that had happened. He was held in great Veneration among the *Greeks*, who imagined him a peculiar Favourite of Heaven. He is ſaid to have lived till 150 Years old, or, according to others, 297.

have

have an Idea, and is nothing more than an unuſual Combination of thoſe Objects we are already acquainted with, affords ſo much Delight, what an infinitely greater Pleaſure muſt this Man have in a World of Things really new, and a new Combination of thoſe Ideas which he before had joined to thoſe with which the Addition of another Senſe abundantly Supplies him. But as human Happineſs is too often attended with ſome Allay, is it not poſſible for him to ſee ſomething that would make him wiſh his Eyes ſhut again when they were hardly open? He would have great Reaſon to believe, that thoſe Objects would appear pleaſing to this new Senſe, which had been ſo to the reſt, and flatter this as agreeably as they had done thoſe. But might not the Event happen quite contrary to his Expectation? And thoſe Objects which had delighted his Touch and Hearing, prove very diſagreeable to his Sight? So that inſtead of increaſing the Number of his Pleaſures, this new Senſe would deprive him of the moſt

ſenſible of them, and perhaps cruelly diſſolve ſome pleaſing Tye which the others had cloſely bound.

It is too true, anſwered I, that theſe Senſes do not always agree: How many Perſons do we daily ſee who, convinced by ſorrowful Experience, that the Reality of Things does not agree with their outward Appearance, find themſelves too ſoon in Poſſeſſion of what they once thought they could never obtain ſoon enough? A blind Man, anſwered the Marchioneſs, at leaſt while he is in Love, ſhould never deſire to ſee; ſatisfied in the Judgment of thoſe Senſes which repreſent an Object agreeable to him, why ſhould he ask that of another which perhaps would at once condemn his Choice, and, like Reaſon, probably make him ſee his Misfortune without giving him any Aſſiſtance to avoid it? The only Conſolation, anſwered I, that this miſerable Perſon could have under the Misfortune of Sight is, that he would not be unhappy ſo ſoon as you perhaps imagine. How? ſaid ſhe, if the Joy of receiving

his

his Sight did not entirely deprive him of all Complaiſance, would not the very firſt Thing he deſired to ſee be that Perſon for whoſe Sake he principally wiſhed for the uſe of his Eyes? And when he had ſeen her, he would immediately, if ſhe ſhould appear diſagreeable, perceive his Unhappineſs, if, with regard to Beauty, Love did not render him a ſecond Time blind. He would enquire for her, anſwered I, would ſee her, and yet would not by that Means know her again. This would be a Miracle even beyond the Power of Love to effect, he would hear, if you will, the ſound of thoſe Words pleaſing to his Ear, and ſtill more pleaſing to his Heart, but he would not know the Mouth from whence they proceeded. Yet more, he would be ſo far from diſtinguiſhing another, that he would not diſtinguiſh himſelf, his own Feet or Hands from any Aſſiſtance his new Sight could give him, ſince he muſt be utterly ignorant of the Connexion which the Perceptions of Sight have with thoſe of the Touch, yet

yet this Connexion is abſolutely neceſſary in order for his knowing thoſe Objects again of which he had no Idea, but what he received from Senſes of a Nature very different from that of Sight, and depends upon an Experiment which he has never yet made. His own Hands would be the firſt Object, he would learn to diſtinguiſh by touching and looking upon them at the ſame Time, and remembring that ſuch an Idea of his Feeling, would agree with ſuch another of his Sight. When he had learnt this ſhort Leſſon, Love would the more eaſily conduct him to thoſe Experiments that would ſoon either to his Joy or Sorrow ſatisfy his Curioſity, and we will conduct him to thoſe that may content ours, which is of a more philoſophical Nature.

One of the firſt he would try, would be to lift up that Hand which he has now no Trouble to diſtinguiſh, and in doing this, he would perceive ſome change in the Senſation which he received of it from his Sight, and the

Reaſon

Reaſon of this Change is becauſe the Image changes its Situation in the *Retina*, in Proportion as the Hand is higher or lower. Guided by Nature herſelf, he would diligently obſerve what ſort of Senſation he felt when he held his Hand up, and whenever he felt the ſame Senſation raiſed in him, either by the ſame or any other Objects whoſe Image would fall in the ſame Situation of the *Retina*, though unknown to him, he would conclude that Object to be high, or in that Situation in which his Hand at firſt was. By this Means connecting the old Ideas of Feeling, with the new ones of Sight, he judges of the Height or Lowneſs of the Object, of its being direct or inverted, and it is of no Importance whether the Image of this Object be pictured upon the *Retina* direct or inverted, or in any other Poſition.

External Objects are *ſignified* to him (if I may uſe that Expreſſion) by certain Senſations of Light and Colours, as the Thoughts of the Soul are to

us

us by certain Characters, not by Virtue of any Reſemblance between the one and the other, but by Means of an arbitrary, yet conſtant and perpetual, Connexion which we have obſerved between them. And as when we are accuſtomed to any particular manner of writing, it makes no Change in the Order of the Ideas which theſe Characters excite in us, whether they be written from Left to Right as ours are, from Right to Left like the *Oriental*, or from Top to Bottom after the *Chineſe* Manner; ſo whether certain Images be drawn direct or inverted upon the *Retina*, it does not at all change our Judgment of their Situation.

The blind Perſon who has hitherto ſafely conducted us through this Labyrinth, reſembles each of us. We enter into Light with our Eyes ſhut, and probably do not begin to *ſee* till we have for ſome Time *felt*. Thus, *Madam*, you are indebted to the predominant Senſe of Feeling, for this new Explication too, and however little you may imagine

imagine it, you will find that to this you have had the greateſt Obligations through the whole Courſe of your Life.

I ſee very plainly, ſaid ſhe, that you intereſt your ſelf for the Honour of the Touch, much more than for that of *Des Cartes*, and it is not poſſible to propoſe any Difficulty but you will be ready to give it a Solution by the help of this Senſe. There are other Difficulties, anſwered I, which I will give you a Solution of without this, that you may ſee I have great Plenty of Explications. One of theſe perhaps may be to know what Change muſt be made in the Eye, in order for it to have a diſtinct View of Objects placed at different Diſtances. For as in the *Camera Obſcura*, the Rays which flow from Objects that are near unite at a greater Diſtance from the *Lens* than the Rays of thoſe which are more remote; ſo the very ſame Thing happens in the Eye where the Rays, which proceed from the Pillars of this

this Gallery, unite at a greater Diſtance from the Cryſtalline Humour, than thoſe that come from theſe Trees which are farther from it, what Change then muſt be made in the Eye, in order that when we look upon theſe Trees, after having looked upon the Pillars, the Rays which proceed from them may be united upon the *Retina*, or in other Words, that we may have a diſtinct View of them? The *Retina*, anſwered ſhe, muſt be brought nearer the Cryſtalline Humour, juſt as the Paper in the *Camera Obſcura* is brought nearer the *Lens*, in order to give us a diſtinct Image of the more remote Objects.

You have hit upon the true Explication, anſwered I, and ſome have affirmed that certain Muſcles which incompaſs the Eye, are made uſe of to produce this Effect, and preſs the *Retina* farther back from the Cryſtalline Humour, or bring it more forward, as different Occaſions require. Theſe Muſcles have beſides another Office,

Office, and help us to lift up or depreſs the Eye, to turn it to the Right or Left, and give it a certain oblique Motion which *Venus* has the principal Care of regulating. Others have ſuppoſed that the *Retina* remains immoveable, and that the Cryſtalline Humour approaches nearer to it, and removes farther off, or that the Cryſtalline Humour only changes its Figure, growing more convex for near Objects, and leſs ſo, for thoſe which are diſtant; and others have affirmed that each of theſe happens at the ſame Time, which will produce the ſame Effect as if the *Retina* approached to or receded from the Cryſtalline Humour; but you had better ſuppoſe this latter, becauſe it is eaſieſt to imagine. For every Diſtance then, there is required a new Conformation in the Eye, and becauſe this cannot be effected without Motion and a certain Effort, ſome are of Opinion that the Eye informs us of the various Diſtances of Objects by a certain natural Geometry. But this way of judging, eſpecially

eſpecially where very diſtant Objects are concerned, is extremly uncertain, as indeed almoſt all the reſt are which have ever appeared upon the Stage of Philoſophy.

But however this be, there are ſome Perſons who cannot bring their *Retina* ſo near to the Cryſtalline Humour as is neceſſary in order to give them a diſtinct View of diſtant Objects. There are others who, on the contrary, cannot preſs it back far enough to make Objects which are near appear diſtinct. The firſt of theſe, who are vulgarly called Short-ſighted, are by Opticians named *Myopes*, and the ſecond, commonly called Long-ſighted, *Presbitæ*; theſe may be conſidered as the Extremes betwixt which that Sight, which is called juſt and perfect, ſtands. Notwithſtanding the Honour of being diſtinguiſhed by Names drawn from *Greek*, theſe Perſons could not help perceiving they had a Defect in their Eyes, which led them to ſeek for ſome Remedy. The *Myopes*, in order to have a diſtinct View of diſtant

Objects

Objects, and the *Presbytæ* of thoſe at Hand. Theſe laſt found Relief in Convex-glaſſes, which applied to the Eyes removed their Defect; for theſe making thoſe Rays to become converging, which would without their Aſſiſtance have fell diverging upon the Cryſtalline Humour, unite them at a leſs Diſtance than they would otherwiſe have done, and the Image of thoſe Objects which are oppoſite to the *Lens* is drawn diſtinctly upon the *Retina*. The *Myopes* found their Remedy in Concave-glaſſes which diſperſe the Rays and make them diverge; contrary to the Convex ones which make the diverging Rays become converging. Theſe Concave-glaſſes then give a Diſpoſition to the Rays as if they came from a nearer Object than they really do, and applied to the Eye of a *Myop*, they in a certain Manner tranſport the diſtant Object to a nearer Situation, and thus a diſtinct Image of it is drawn upon his *Retina*; for there is nothing more required to give Short-ſighted Perſons a diſtinct

View of any Thing, than to bring it nearer their Eye.

It was very happy for them, replied ſhe, to find theſe Glaſſes as ſafe and eaſy a Remedy perhaps as ever the Art of Phyſic itſelf invented. But what did they do before they were found out? Till the thirteenth Century (anſwered I) when theſe Glaſſes are ſuppoſed to have been invented, the *Myopes* were obliged to approach near to diſtant Objects in order to ſee them diſtinctly, hoping perhaps that an advanced Age (when according to the common Opinion the *Retina* approaches nearer to the Cryſtalline Humour) might give them ſome Relief from this Inconvenience; but indeed this is a Remedy much worſe than the Diſeaſe. The *Presbytæ* on the other Hand were obliged to remove a great way off, without any hope of ever ſeeing the Objects ſituated near them diſtinctly, if they ſhould at any Time have a Curioſity for it, and they continually tormented their Eyes with Plaiſters and *Collyria* without gaining

gaining the leaſt Advantage to their Sight. I think the Condition of theſe laſt, ſaid the Marchioneſs, much more to be pitied than that of the firſt, both becauſe they cannot flatter themſelves with the leaſt Hope of growing better, and becauſe they loſe a great deal more in the Converſation of Ladies than the *Myopes* do. How miſerable muſt have been the State of a poor *Presbyta*, who could never have a diſtinct View of his Miſtreſs, unleſs he breathed his Sighs ten Foot diſtant from her!

Theſe are not ſo much to be pitied, anſwered I, as you imagine, ſince this Defect generally happens in an Age when Hope and the Converſation of Ladies naturally deſert us. For this is a Defect of old Men, as the very Word *Presbyta* imports. But there are other Defects and Infirmities of the Sight incident to all Ages, which are never placed in the Number of Defects, for the very ſame Reaſon that the Folly of being more ſolicitous for the future than the preſent, and by that Means conti-

nually procraſtinating our Happineſs, is never reckoned among the Liſt of Follies, namely, becauſe it is common and univerſal. Philoſophers, who have a quicker Perception of Things, have diſcovered and ſought Remedies for theſe Defects, one of which is, that very ſmall Objects are inviſible, however near they may be placed to the Eye, the other, that very diſtant Objects cannot be diſcerned, even if they are of a very great Magnitude. Theſe are Inconveniences which you ſee are not at all felt by the Vulgar, but reſerved for the Curioſity and nice Perception of Philoſophers. The Reaſon of both Defects is, becauſe the Image of very ſmall or very diſtant Objects, painted upon the *Retina*, is not big enough to be perceived by the Eye, notwithſtanding any Proximity of the one, or extraordinary Magnitude of the other. The Remedies invented by Philoſophers to ſupply them are certain Inſtruments, whoſe only Buſineſs is to magnify this Image and render it

perceptible to the Eye, by Means of various Combinations of Glaſſes, or by one alone. Thoſe which are made uſe of to diſcern diſtant Objects, are called *Teleſcopes*, and thoſe which help us to a Sight of exceeding ſmall Objects, *Microſcopes*. We are obliged to each of theſe for an infinite Number of Diſcoveries, which could never have been made without them. The Heavens are the principal Object of the *Teleſcope*, from whence it has furniſhed Philoſophers with more Curioſities than ever *Columbus* could bring from *America* to inrich the Cabinets of the Naturaliſts. For not to ſpeak of the Hills and Vallies which they have diſcovered in the Moon, the *Satellites* of *Jupiter* ſo very uſeful to *Geography*, thoſe of *Saturn* with his *Ring*, it is to thoſe *Teleſcopes* that we owe our Diſcovery of the Spots in the Sun, *Jupiter* and *Mars*, which are neceſſary in order to determine the Periods of their Revolution round themſelves, and by the Aſſiſtance of theſe Aſtronomers have given us ſo exact a

Map of *Venus*, that they are as well acquainted with her Mountains in Heaven as the *Geographers* are with thoſe upon Earth. They have diſcovered that this Planet has an Increaſe and Decreaſe, that it is at one Time half, at another full, in ſhort, that its Appearance and Phaſes exactly reſemble thoſe of the Moon, as it had been conjectured by the celebrated *Copernicus* before the Invention of the *Teleſcope*. Theſe give the Celeſtial Bodies their proper Diſtances, and have ſhewn us an infinite Number of Stars unknown to the Antients, diſcovering ſo great a Quantity in the Milky-way as is ſufficient to ſupply ten or twelve Worlds beſides our own. In ſhort, they have given us a true Syſtem of our World by extending its Confines to Infinity, ſo that if a Poet to flatter a Nation which had made a greater Progreſs in the Conqueſt of the World, than in the Knowledge of its Frame, could ſay that when *Jupiter* turned his Eyes upon our Earth, he could ſee nothing in it that was not

ſubject

ſubject to the *Roman Empire*, we may affirm with greater Truth, that if he looked upon the Heavens, or at leaſt the *Solar Vortex*, he could not ſee any Thing in it but what is the Diſcovery and Conqueſt of the *Teleſcope*.

You repreſent theſe *Teleſcopes* to me (replied the Marchioneſs) under ſuch ſublime Images, that I am afraid the *Microſcopes* will make but a very inſignificant Figure when compared to them. There is, anſwered I, a very remarkable Difference between them, in which I believe the laſt have the Advantage. The *Teleſcopes*, 'tis true, by diſcovering to us the Hills and Vallies in the Planets, their Stations, Revolutions round their own Axis, (that is to ſay, their Day and Night) the Moons that from Time to Time ſupply the Abſence of the Sun; in ſhort, by repreſenting them to be of the ſame Nature as our Earth, have furniſhed us with Materials to people theſe vaſt and immenſe Bodies which were before uninhabited, ſtood neglected in a Corner of the Univerſe,

and were believed to exiſt for no other End than to pleaſe our Eyes. But *Microſcopes* have made us in Reality ſee an infinite Number of Animals of which we had not the leaſt Knowledge before, in Things which were not looked upon as very proper to afford them a Habitation. Not to ſay any Thing of the Diſcoveries in *Anatomy* and *Natural Hiſtory*, which we owe to theſe Glaſſes; Aromatic Infuſions, a Drop of Vinegar, are peopled by ſo prodigious a Number of little Animals, that *Switzerland* and *China* would appear empty and uninhabited when compared to them. The *Microſcope*, ſaid ſhe, is the Compaſs of Philoſophy; each of theſe have given their Aſſiſtance to the Diſcovery of new Worlds; the only Difference is, that the *Microſcope* has lent its Art to people, and the Compaſs to deſtroy.

It is very wonderful, anſwered I, into what innumerable animal Worlds Philoſophers have penetrated under the Guidance of this Compaſs. It is an amazing

amazing Thing to reflect upon the Minuteneſs, Art, and Curioſity of the Joynts, Bones, Muſcles, Tendons, and Nerves neceſſary to perform the ſwift Motions of the ſmalleſt microſcopical Animals.

Theſe Diſcoveries ſhew us in how little a Compaſs all Art and Curioſity may be compriſed, even in a Body leſs than a ſmall Grain of Sand, and yet as compleat, as exquiſitely formed, and as finely adorned as that of the largeſt Animal. Their Multiplicity is no leſs ſurprizing than their extreme Smalneſs. A Drop of the green Scum upon Water no bigger than a Pin's Head, will contain not fewer than an hundred; which far from being confined in that narrow Extent, play about in it with all the Freedom imaginable. The Eye of a Butter-fly will contain more than twenty-four Millions; and the Wonder is ſtill greater when we come to conſider the Organization of their fine and minute Parts. If the Eye of a Fly, which ſeems to be a

little misformed Protuberance, be looked on through a *Microſcope*, it appears to be only a Compoſition of thouſands of little Eyes, juſt as ſome nubilous Stars on being viewed with a *Teleſcope* appear to be a Cluſter of innumerable other Stars. In ſome Inſects there have been counted no leſs than thirty-four thouſand of theſe little Eyes, which notwithſtanding their extreme Smallneſs had each of them a Cryſtalline Humour as perfect as ours.

Why are not our Eyes, ſaid the Marchioneſs, of ſo fine a Texture? This Queſtion, ſaid I, has been already anſwered,

For this plain Reaſon, Man is not a Fly.

Say to what Uſe were finer Optics given,

To inſpect a Mite, not comprehend the Heav'n.

But

But in Fact there are ſome Inſects, that with theſe microſcopic Eyes can ſee as far as the greateſt Part of Men. The Bees, an induſtrious Species of Flies, from whoſe Labour we reap ſo great an Advantage, can direct themſelves ſafely to their Hives though at a Mile Diſtance, when they return laden with the ſweet Treaſures of the Spring. It appears that what Nature has given us in Reaſon, ſhe has denied us in Exquiſiteneſs of Senſe. Pigeons, the Couriers of the *Eaſt*, ſuch as that which brought News from *Egypt* to *Jeruſalem* when it was beſieged of a quick and powerful Succour, or that beautiful one preſented by *Venus* to *Anacreon* in exchange for one of his Odes, and which, for having ſo often carried his Letters to *Bathyllus*, deſerved to ſleep, and be ſung upon that Lyre which could reſound nothing but Love; theſe flying Couriers, I ſay, being let looſe by the Perſon who has a Mind to ſend home News of himſelf, aſcend a prodigious Height, and from thence, though at a very great Diſtance, can ſee their native

Country, and ſafely direct their Flight to it without the help of either Stars or Compaſs. Moles ſeem to be quite contrary to theſe ſharp ſighted Couriers. Nature, ſaid the Marchioneſs, has perhaps made them amends ſome other Way. It is probable that ſhe has conſtituted the Condition of Animals pretty near as equal as that of Men. Their Eyes, anſwered I, are certainly not to be envied: They are ſo ſmall and covered with Hair, that it ſeems as if Nature had given theſe Tenants of Darkneſs Eyes to ſee the Light, for no other End than to fly from it. Theſe Animals are not formed to contemplate the Wonders of the *Microſcope*, nor ſee in one Drop of Water ſo many thouſands of Animals, organized with all that Exactneſs which is neceſſary to enable them to ſee, move, and nouriſh both themſelves and other little Animals, which repay them the Miſchief they do to us, and to contain within them an infinite Number of ſtill other little Animals of their own Species, much leſs than they, and which only wait to un-

unfold themſelves to make their Appearance in the *Microſcope*. Theſe Obſervations open a Scene of innumerable other Worlds of Animals unknown before, which notwithſtanding their extreme and ſurprizing Smallneſs, have their greater and leſs, their Elephants and Ants juſt as ours has; the only Difference is, that our Ants become Elephants when compared with their largeſt Animals, or rather are as the immenſe Diſtance of *Saturn* from us, is to the Extent of a Grain of Sand.

Indeed, ſaid the Marchioneſs, this new Scene of Pigmy Worlds gives me as much Pleaſure as that other immenſe and Gigantic Scene of *Vortices* or Suns diffuſed over the whole Univerſe. The little has its Beauties as well as the great, or rather, anſwered I, there is no great or little, but with regard to ourſelves. *Gulliver*, who could deſtroy the *Liliputians* like ſo many Fleas, was among the *Brobdinagians* kept in a Cage like a Canary Bird, or for an Ornament upon the Chimney like a *Chineſe Pagod*. It

is

is principally the *Microſcope* and that infinite Number of Pigmy Worlds diſcovered by it, which has rectified our Ideas of great and little, ſo much that I am perſuaded, that the Conſideration of this incredible and ſurprizing Smallneſs, which it has rendered perceptible to our Senſes, has ſerved to ſoften and familiarize to Mankind another Conſideration which is the Maſter-piece of human Underſtanding, and directly leads us to the Subverſion of great and ſmall. This is the Conſideration of infinitely ſmall Quantities which has made ſo great a Noiſe in the learned World, and which you perhaps may have heard of. The meaning of this Expreſſion is, that there are Parts and Quanties in Extenſion, ſo exceedingly ſmall, that they may be reckoned as nothing when compared with our Meaſures, as the Fathom, Foot, Ounce, and the like. So that if one of theſe Quantities was added to the Extremity of a Line (for Example of a Foot,) it would not increaſe the Length of it, nor decreaſe it if it was to be taken away. And the Mathematicians affirm, that in theſe Quan-

Quantities, infinitely ſmall with regard to the ordinary Meaſures called *Differences*, there are innumerable Orders and Gradations, ſo that a Quantity which is infinitely ſmall compared with the Order of our common Meaſures, is infinitely great when compared with an inferior Order of infinitely ſmall Quantities, and ſo of the reſt. The moſt enormous Sizes we have may become infinitely ſmall when compared with an Order of Greatneſs infinitely ſuperior. To how ſmall a Size is reduced the *Coloſſus* of *Nero*, or that of *Rhodes* when compared to Mount *Athos*, carved in the Shape of a Man, and holding a City in one Hand, and pouring out a River from the other? Compared to *Milton*'s *Satan*, *Virgil*'s *Fame*, the formidable Shade of [a] *Camoens*, that *Polypheme* of the Ocean

[a] *Camoens*, the famous *Portugueſe* Poet in his *Luſiada*, the Subject of which is the Diſcovery of the *Eaſt Indies* by his Countrymen, conducts their Fleet round the Coaſt of *Africa*, and as it ſails in ſight of the *Cape* of *Good Hope*, he introduces a formidable Spectre walking in the Depth of the Sea, its Head reaching to the Clouds, its Arms extended over the Waves, and its whole Form ſurrounded with Clouds, Storms, Winds, Thunders, and Lightnings. This Spectre

Ocean which appeared to the *Portugueſe* Sailors, hid its Head in the Clouds, and its Feet in the unfathomable Abyſs of the Sea; or in ſhort, what would all this appear to that Angel ſeen by *Mahomet* in his myſterious Night, whoſe Eyes were ſeventy thouſand Days Journey diſtant from each other? It is computed that if he were of a human Shape, there muſt be the Diſtance of forty thouſand Years Journey from his Head to his Feet.

Probably, ſaid the Marchioneſs, there muſt be a great Number of *Teleſcopes* and Speaking-trumpets in the *Turkiſh* Paradiſe, in order for the *Mahometans* to be able to ſee and converſe with theſe diabolically great Angels of theirs.

There are, anſwered I, the ſame Orders of Infinites in the Succeſſion of Time, as there are in Extenſion. An-

Spectre is the Guardian of that foreign Ocean which no Ship had ever paſſed through before, complains of his being obliged to ſubmit to Fate, and the bold Undertaking of the *Portugueſe*, and foretels them the Misfortunes they muſt undergo in the *Indies*.

Hour,

Hour, a Minute, a Second, are of an infinite Duration compared with Periods of Time infinitely ſhorter. How enormous muſt the Duration of the *Roman Empire* ſeem to an Animal, which in the Space of five or ſix Hours is born, grows up, produces one like itſelf, becomes old and dies? What we ſhould call the Flight of Time, would ſeem to this Inſect an Eternity. But what are theſe Durations of Empires, this long Succeſſion of Kings, Emperors, Conſuls, and theſe tedious Sieges when compared with Eternity? Is it more than a Point in which we live, fight, raiſe ſuch great Commotions, and make ſo much Noiſe? The *Orientals* ſay, there is a God that governs this World, who dies at the End of a hundred thouſand Years, and this Space another ſuperior God eſteems but as a Minute. And yet all theſe Examples give us but a very imperfect Idea of Infinity. This Conſideration, the utmoſt Stretch of the human Mind which we owe to Sir *Iſaac Newton*, and which entirely overthrows all the Ideas of abſolutely great or little,

was

was the Foundation of the famous Arithmetic of *Fluxions*, or infinitely ſmall Quantities, which tranſplanted Geometry into a Province intirely new. Here it made ſo rapid and great a Progreſs, that all it had done before ſeems nothing, and here by the Aſſiſtance of new Diſcoveries it produced ſuch ſtrange Paradoxes, that they have in ſome Meaſure clothed Truth in the agreeably ſurprizing Dreſs of Fiction: And what is the moſt remarkable in the new *Geometry* is, that by conſidering the Properties, Relations, and Habitudes between infinitely ſmall Quantities, it arrives at the Diſcovery of common and finite Meaſures, which are the Object of our Enquiries.

If the Sagacity which we ſo much admire, ſaid ſhe, conſiſts principally in uniting thoſe Things in the Mind, and finding their Relation, which ſeem to be in their own Nature disjoined and ſeparated, what an unlimited Underſtanding muſt Sir *Iſaac Newton* have had to find the Relation, and in ſome Meaſure unite theſe Quantities, disjoined

and

and ſeparated from each other by the immenſe Tracts of Infinity, where the human Imagination quite loſes itſelf. And, continued I, the Conſideration of theſe infinitely ſmall Quantities that we neither ſee nor can conceive, which appeared only fit to perplex *Geometry*, have in Fact ſerved to render it more eaſy, and reduced it at the ſame Time to ſuch general Rules that the moſt ſublime and abſtruſe Truths in this Science are at preſent nothing but one of the infinite Conſequences which is loſt among the Crowd of thoſe that are deduced from the Stroke of a Pen; and if you pleaſe in a Circle of Ladies; Truths that once required an *Archimedes* with all that Attention of Thought which was neceſſary to make a Perſon inſenſible of the Noiſe of a Town taken by Storm, and be knocked on the Head without perceiving it.

This Conſideration then of infinitely ſmall Quantities (ſaid the Marchioneſs) and the Obſervations of the *Microſcope* which have rendered it more familiar and common, have given a very ſtrange

Turn

Turn to *Geometry*. It now treats of Quantities, which from their extreme Smallneſs were once utterly unknown, and does not at preſent diſdain to enter into the Company of Ladies. A Province with which I believe it was once as little acquainted, as with that of the infinitely ſmall Quantities. It is true, anſwered I, that *Geometry* is rendered ſo very familiar, as ſometimes to ſuffer itſelf to be treated by a Hand as beauteous as that of *Venus* of *Medicis*: But 'tis true likewiſe, that it ſometimes reſumes its fierce and ſavage Diſpoſition, eſpecially when it is attended by that Train of Conſequences, deduced from the Stroke of a Pen, as I before mentioned to you, and goes back into Solitude and Retirement.

Mankind however (ſaid ſhe) ought to think themſelves greatly obliged to the *Microſcope* for having contributed to ſoften and familiarize a Thing whoſe very Name alone inſpired ſo much Terror. Mankind, anſwered I, are not very often guilty of the Sin of Gratitude, and, as that polite Philoſopher, who

who is to inſtruct you in the Motion of the Earth, obſerves, there are ſome who make no Scruple to treat the Study of Anatomy (which perhaps may have ſaved their Lives) as a uſeleſs Thing. You may judge from hence, whether it be probable that Mankind will be grateful at the Expence of ſo much Conſideration as is neceſſary in order to know whether *Microſcopes* have contributed any Thing to familiarize the Calculation of infinitely ſmall Quantities, what this Calculation is, and what Uſes it may have; all which Things are neceſſary to form a well-grounded and rational Gratitude. An *Engliſh* Frier called *Roger Bacon*, who lived in the thirteenth Century, and had a general Knowledge of the Effect of the *Refractions* of Light by a *Lens*, and was beſides acquainted with many other Things which are commonly believed to be the Production of much later Ages, ſuch as the Invention of Gunpowder, the Reformation neceſſary to to the Calendar, and was ſenſible of the falſe Method of Study at that Time in Faſhion;

ſhion; this very Man, worthy of a Statue and immortal Honours, was ill treated, perſecuted, kept Priſoner for many Years, accuſed as a Conjurer and Wizard, and of holding Intelligence with the Devil, in order to effect what required only ſuperior Parts, and a free uſe of Reaſon; and all the Honour theſe Inventions, which we at preſent ſo greatly admire, met with at that Time was, that the Inventor was judged worthy to be burnt alive. It is true, that at preſent the Learned cannot enough admire the Depth of Underſtanding and the quick Penetration of of a Man, who, in ſo barbarous an Age as the thirteenth Century, thought in a Manner that very few of his Species do even in this Age, as inlightened as it is. But what Gratitude is this to perſecute, impriſon, and almoſt burn him when living, and at the End of five Centuries, to republiſh and give him the higheſt Encomiums? Is not this like deifying *Homer* after his Death, when he had been ſuffered to ſtarve with Hunger while living? The *Teleſcopes* which

which have been the Cauſe of ſo many fine Diſcoveries, had no leſs Reaſon, in the Beginning of the laſt Century, to complain of the Ingratitude of Mankind. The Spots in the Sun, the *Satellites* of *Jupiter*, and the various Appearances of *Venus* were imputed to them as ſo many Deceptions of the Sight, of which they alone were guilty. There was no Calumny ſo black that was not thrown upon them, and he who (I will not ſay invented them) but at leaſt made ſo many fine Diſcoveries in the Heavens by their Aſſiſtance, did not by that Means at all advance his Fortune here upon Earth.

It is ſurprizing, ſaid the Marchioneſs, to ſee the Folly and Caprice of Mankind. In ſome Caſes they are ſo extremely fond of Novelty, as to adopt the moſt extravagant Things merely on that Account. This, we ſee, happens, every Day in the Faſhion of Dreſs, ſitting, taking Snuff, and even Sneezing. At another Time, Novelty is an Objection to the moſt uſeful and well con-

every

trived Schemes. Are our Judgments never to be guided by Reaſon?

The wiſe Men of paſt Ages, anſwered I, appear to us like the Moon juſt on the edge of the Horizon, and thoſe of the preſent Time, like the ſame Planet, when it is a great way above it. The Image of the Moon painted on our *Retina*, when ſhe is at the Horizon, is leſs than when ſhe is elevated a great way above it, at the Meridian, (for Example;) and this is occaſioned by the Diſtance of the Moon from us, which is greater in the firſt Caſe than the ſecond. Yet notwithſtanding this, we imagine her to be much bigger at the Horizon than at the Meridian. This Miſtake proceeds from the Interpoſition of other Objects, as Trees, Houſes, Tracts of Land, Sea and Sky which are betwixt us and the Moon, when at the Horizon, but not when ſhe is at the Meridian, for in that Situation ſhe is left intirely to herſelf. Now as the Objects placed betwixt us and the Moon, make us imagine that ſhe is more diſtant from us at the Horizon

rizon than the Meridian, they are the Reaſons too why we imagine her to be bigger, becauſe the apparent Bigneſs of an Object depends on the Size of its Image on the *Retina*, joined to the Judgment we form of its Diſtance; ſo that the Image being always of the ſame Size the Object muſt appear ſo much the greater, as it is judged to be more diſtant. Hence it is that Actors, when they come from the Bottom of the Theatre, appear to us like Giants, the Perſpective and the Deluſion of the Scene making them appear a great way off. Why ſhould thoſe Objects placed betwixt us and the Moon, when at the Horizon (ſaid the Marchioneſs interrupting me) make us imagine her to be farther off from us than when ſhe is at the Meridian? I ſhould think they would rather make her ſeem nearer, for in that Situation ſhe appears to touch them, and it ſeems probable ſhe ſhould appear at the ſame Diſtance from us as the Objects themſelves: whereas at a greater Altitude we ſee her placed in the Sky, and conſequently judge her

to be at a great Diſtance. We know, anſwered I, that the Moon in both Caſes is in the Heavens, or rather that the Heavens themſelves are an immenſe Vault to which our Imagination always refers the heavenly Bodies. But the Sky itſelf ſeems much more diſtant from us at the Horizon, than when we look directly above our Heads, ſo that it appears to us as a compreſſed Vault. Between us and that part of the Heavens which is over our Heads, there is nothing to regulate our Judgment of its Diſtance, whereas at the Horizon the long Series of intermediate Objects helps us to form the Diſtance, and makes us judge it very great. Hence it comes to paſs, that Diſtances appear much greater upon a Plain than a Mountain; becauſe the Equality of the Plain lets us ſee every Thing that is placed between us and the diſtant Object, which the Inequality of the Mountain will not ſuffer us to do.

In the famous Picture of *Correggio* at *Parma* (ſo ill copied by the Chizel of *Agoſtius Caracci*, who was otherwiſe

a great Man in his Profeſſion) an artful Series of Hands, Heads and Feet place a Diſtance between St. *Catharine* and the Head of the *Madona*, ſo ſenſible that you would imagine it might be meaſured by the Touch, and which, added to the other Beauties and Graces of Art all united there, render it a Maſter-piece of Painting.

Now (to finiſh our Optic Compariſon) the Antients appear to us through a long Series of Emperors, Kings, Archons, Conſuls, and many other Objects, which greatly magnify them: But we ſee the Moderns alone, ſeparated, and left entirely to themſelves like the Moon at the Meridian. Hence it is, that the Manner in which the Antients buttoned their Coats will be a Subject of Admiration to the Learned; whereas there will be only two or three Men of good Senſe to applaud any uſeful Invention of a Modern, who has the Misfortune to be born in the ſame Age with ourſelves, and not to be diſtinguiſhed by a Name with a *Greek* Termination. And this is the Way in

which a great part of thoſe who value themſelves upon their Learning, think. *Horace* very finely ſatyrized this Folly even in the Time of *Auguſtus*. So true is it, that a wrong Turn of thinking is the Growth of every Age.

But would not the *Chineſe* (ſaid the Marchioneſs) be Gainers by the immenſe Diſtance between them and us? And may not a Million of Miles produce the ſame Effect as many Succeſſions of Kings and Conſuls? They are certainly no Loſers by it, anſwered I, but however thoſe very Perſons who moſt idolize this Nation (which in the midſt of Obſervators and Aſtronomers could not produce a tolerable Almanack) agree that we are ſuperior to them. This Confeſſion perhaps is the Effect of National Self-Love. The *Chineſe* form a Nation entirely ſeparated and different from us; whereas the Antients are as it were of the ſame Family with ourſelves, and we regard them as our Anceſtors. And after all, ſome few ſorry thouſand Miles can never be equivalent to a Liſt of

Archons

Archons or Conſular *Faſti*. In ſhort, it is here, as in the Compoſitions of the Theatre, in which People ſuffer themſelves to be much more eaſily deceived in what regards the Cuſtoms and Manners of the antient *Greeks* and *Romans*, than in thoſe of the *Turks* or *Japoneſe*.

Another Inſtance in which this Compariſon holds good between the Antients and the Moon at the Horizon is, that ſhe appears the greater to us upon the Account of her being leſs reſplendent there, than when ſhe is at the Meridian. Thoſe Objects which are the fartheſt off, are the leaſt illuminated. So that if two Objects are of an equal Size, the leaſt illuminated will be thought the moſt diſtant, and conſequently the biggeſt. Hence Trees and Houſes appear greater to Travellers in the Twilight, than in full Day, the Sun ſeems bigger when ſeen through a Cloud, and Objects muſt generally appear greater in *England*, than they do in *Italy*. The Sun, after the Death of *Julius Cæſar*, continued pale and languid for the Space of a

Year, and according to the Expreſſion of an elegant Poet, threatned that guilty Age with an eternal Night. If the *Romans* had dealt in Obſervations, I do not doubt but they would have informed us, that he appeared likewiſe bigger than ordinary. Objects then (ſaid ſhe) are magnified by the Miſts of Antiquity, many of thoſe great Philoſophers, whoſe Names now paſs for a Proverb, were perhaps no more in their own Time than the Regent of a College, or the Lector of a Univerſity. Thoſe, anſwered I, who are the moſt devoted to them, are the moſt likely to ſee them greatly magnified: For (as the fineſt and moſt judicious Verſes in the World inform us) Fools *admire*, but Men of Senſe *approve*, and every Thing appears magnified to Dullneſs, as Objects do when ſeen through a Miſt. I ſhould not at all wonder if ſome profound Admirer of the *Greeks* ſhould prefer the *Epicurean* Explication of Viſion to that of the Moderns, for this only Reaſon, that one is more antient than the other.

What

What Explication is this (ſaid the Marchioneſs) for I do not remember that you have mentioned it to me before? It was the laſt I ſpoke of, anſwered I, when we were talking yeſterday about the Explications which the Antients have given of Sight. This ſuppoſes that certain Shadows or Images fly off from Bodies, by whoſe Means we ſee. Though this may ſeem reaſonable enough to ſome Perſons, yet there ariſes a great Difficulty to explain how it happens, that when we are in the Dark we ſee Objects that are placed in the Light; but when we are in the Light, we cannot diſcern Objects placed in the Dark: Since according to this Explication of the *Epicureans* in both Caſes, there are Shadows which fly off from the Objects and raiſe in us the Senſation of Viſion. *Lucretius* calls a certain lucid and ſubtile Air to their Aſſiſtance, which, entering into the Eyes when they are in the Dark, diſengages them from the more thick and black Air that obſcured them, and by this Means opens a Paſſage to the Shadows

which from Objects placed in the Light proceed to the Eye. When Objects on the contrary are placed in the Dark, the thick black Air fills the Eyes, and by this Means denies a Paſſage to the Shadows which are tranſmitted to the Eye from thoſe Objects.

The Image of any Object, ſaid the Marchioneſs, cannot be drawn upon the *Retina*, unleſs there are Rays tranſmitted from the Object to the Cryſtalline Humour, juſt as in the *Camera Obſcura*, an Object, in order to have its Image painted upon the Paper, muſt tranſmit Rays to the *Lens*. If then the Object be placed in the Light and we in the Dark, its Image will be drawn upon the *Retina* and we ſhall diſcern it, but if the Object be placed in the Dark, it cannot tranſmit any Rays to the Cryſtalline Humour, there can be no Image drawn upon the *Retina*, and conſequently the Object cannot appear to our Sight. But I do not ſee what Relation there is between the thick or ſubtile Air of *Lucretius* and theſe Images. It is true, anſwered I, that this

this Air has nothing to do with the Image on which *Viſion* depends, but it has a great Relation to theſe Shadows on which depends the *Honour* of the *Lucretian* Philoſophy. And what is there in the World that a Philoſopher, embarraſſed in the Explanation of a Phænomenon, does not lay hold on? But ſince you have ſo well explained this, I will venture to propoſe to you another, which you muſt often have obſerved, it is, that in going from a very light Place to one which is much leſs ſo, and may even be called dark when compared with the other, the Objects in this Place are at firſt not at all diſcernible, but by Degrees they begin to appear, and after ſome Time are ſeen very diſtinctly. This often occaſions great Miſtakes in Society, which are very ſoon found out and repented of. Any one for Inſtance going into the Chamber of a Lady, who, either becauſe ſhe is indiſpoſed or fancies herſelf to be ſo, likes to ſit in the Dark, may take one Perſon for another, and a fine Compliment be wrong addreſſed, and the Error after-

wards appear to the great Confuſion of the Perſon who had been at ſo great an Expence of Wit in forming it.

This Phænomenon, ſaid the Marchioneſs ſmiling, has very important Conſequences and merits the utmoſt Attention. But I muſt confeſs it appears to me a little more perplexed than the firſt, and I do not know how many Degrees of Subtilty in the Air *Lucretius* would require to explain it by. Yet the Explication of this Phænomenon (anſwered I) depends intirely upon a Thing which you muſt very often have obſerved with the utmoſt Diligence. Have you never remarked that there are no Eyes, not even your own, but appear much finer by Night than in the Day? I agree to this, ſaid the Marchioneſs, that we may not ſpoil our Obſervations by Compliments: But does not it proceed from hence, that the Night does not ſhew the Defects of the Face ſo much as the Day, and therefore the Eyes too muſt be Gainers? The true Reaſon of this Phænomenon, anſwered I, is, that in the Dark the

Pupil

Pupil is more open and dilated, which makes the Eyes look blacker and brighter in the Night than in the Day when the Pupil is more contracted. How many Eyes have triumphed in the Evening and gained Conqueſts which they loſt the very next Morning at the approach of the Sun! The Pupil is contracted in very light Places in order that it may not admit too great a Quantity of Rays which would only ſerve to do it Hurt. On the contrary it is dilated in the Dark enough to admit ſuch a Quantity of Rays as are ſufficient to cauſe Viſion. The Reaſon perhaps why ſome Animals never creep out of their Holes till Evening is, becauſe they are not able to contract their Pupil ſo much as is neceſſary to hinder the Light of the Sun from injuring their Eyes. When we go therefore from a light Place to one which may comparatively be called dark, the Pupil, being at firſt very much contracted, does not admit ſuch a Quantity of Rays into the Eye as is ſufficient to raiſe the Idea of Viſion. The Pupil afterwards begins to dilate

itſelf, and we begin to ſee. And as this Dilatation is made by Degrees, ſo we diſcern the Objects by Degrees ſtill clearer and clearer, till at laſt when the Pupil deſiſts from dilating itſelf at a certain Point, we afterwards continue to diſcern the Objects with the ſame Degree of Clearneſs.

You have not given me the leaſt Time to think on this, ſaid ſhe, who can tell whether I might not have found out this Explication, which now at leaſt does not appear at all difficult to me? It is ſufficient for you, *Madam*, ſaid I, to have explained one Phænomenon, and ſeen the Difficulty of another. A very great Exploit truly, (ſaid the Marchioneſs with ſome Emotion) to ſee Difficulties and not be able to reſolve them. It is a very great Honour indeed for a General to beſiege a Town and not take it? No, ſaid I, but it is ſome times an Honour for him not to undertake the Siege at all. The firſt Step to Wiſdom is, to ceaſe from Folly, and the firſt Point of Learning not to be too arrogant, but perceive our own Weak-

Weakneſs. This is a Point of Modeſty very little practiſed by thoſe Gentlemen who with the Vulgar gain the Reputation of Philoſophers, merely by their declaiming in Aſſemblies and Coffee-houſes, againſt the antient Philoſophy which they know nothing of but the Name, ſtigmatizing thoſe who profeſs it with the Title of *Ergotiſts*, and having read perhaps ſome Preface or Literary Journal. Such ſort of Perſons never doubt of their Knowledge, but explain and paſs a deciſive Judgment upon every Thing. Theſe are blind Men who would walk in a Garden with the ſame Freedom as other People, but the firſt Baſon they come to, fall in. There is an Obſervation which the more 'tis examined the truer it will appear, that nothing in the World is ſo difficult to be met with as common Senſe.

I perceive, ſaid the Marchioneſs, that I have ſome Right to call myſelf a Philoſopher. I have my Head full of *Vortices*; I form Light by the Preſſure alone of the Globules of the ſecond Element, and Colours by their *Rotation*. I have renounced

renounced the moſt agreeable Qualities, and retain nothing but a little Extenſion, and infinitely ſmall Quantities. I am not certain whether the World appears the ſame to all Eyes: I explain one Phænomenon, and ſee the Difficulty at leaſt of another; I think I have Contempt enough for the antient Philoſophy; and after all this I hope it will not be ſaid that I am not wiſer than I was. Do I want any Thing elſe to make me a complete Philoſopher? — Yes, *Madam*, anſwered I, perhaps you ſhould have a little leſs Beauty, or make a better uſe of it. But you do not perceive that the Philoſophy you are ſo fond of needs a Reformation, and I wiſh this Reformation might be the laſt.

What (ſaid ſhe with ſome Emotion) will you tell me that Viſion is not performed in the manner you have hitherto explained it? This is plainly betraying me, and affirming upon your Word what afterwards appears not to be true. No, no, *Madam*, anſwered I, be not uneaſy, I am not of a Character to pro-

propoſe to you Things differently from what they are. Viſion ſhall remain untouched; that Abjuration, which you have generouſly made of the Roſes and Lilies in your Cheeks, ſhall ſtand good and be ratified in Form. The Doubts you are under concerning the different Appearance of Objects in different Perſons, ſhall ſtill continue to be reaſonable, and your preferring the Moderns to the Antients ſhall ſtill be compatible, and remain as it is founded on the very beſt Reaſons. The Reformation I ſpoke of will affect nothing but the Globules of Light, and the manner in which they excite in us the Senſation of Colours. You may hereafter if you pleaſe regard the Syſtem of *Vortices*, as one of the fineſt and moſt entertaining philoſophical Poems in the World, which is the Idea under which I at firſt propoſed it to you. This is abſolutely diſconcerting my Ideas, ſaid the Marchioneſs. I would willingly look upon this Syſtem as ſomething more than a Fable, were it ever ſo fine a one. I cannot think of changing any Thing in the Globules of Light,

Light, which with ſo very little Trouble ſupplied me with the moſt agreeable Colours. If I once quit theſe, who knows how much Pains, and how great an Apparatus it will coſt me after this to make even a ſorry Metzotinto?

It will coſt you no more, anſwered I, than it did with your Globules. This Reformation was produced by Father *Malebranche*; one of the greateſt and moſt illuſtrious *Carteſians* that ever appeared in the World. The Authority of ſo great a Name may let you ſee how very neceſſary this Reformation was, and you may moreover be ſure that the Simplicity which has always formed the Delight of this Sect cannot fail here. This Simplicity is an Idol to which they ſacrifice every Thing, even Truth itſelf ſometimes, that Truth which an Antient called the Citizen of Heaven, and Companion of the Gods. But before I proceed to this Reformation, it will be proper to lay before you the great Difficulties which muſt make you forever renounce your Globules. This Syſtem, like *Hercules* in the Fable, had

had very great Difficulties to encounter with from its very Birth; but perhaps it did not overcome them with equal Honour.

Some objected, and with great Reaſon, that according to thoſe Laws aſſigned to the *Vortices* by their Inventor himſelf, as the Stars are not compoſed of the ſubtile Matter but of that of the third Element, inſtead of being luminous, they would be covered with an opaque Cruſt; and even if they were luminous, the contrary and equal Preſſure of the *Vortices* would not ſuffer us to ſee them.

However weighty theſe Objections might be, they would not be able to ſhake the Faith of the ſteady *Carteſians*. But this, which I am now going to mention, appears an indiſſoluble *Gordian Knot*, even to the moſt zealous and ardent among them. You have this formidable Enemy of the *Carteſian* Philoſophy in your own Houſe, nay, in the very Gallery where we are, and you do not perceive it. This painted Wall is an Adverſary that makes War againſt the

the Syſtem you are fond of. Deliver me from this Perplexity, I intreat you, ſaid the Marchioneſs, or I ſhall eraſe the Picture. You have a Mind to make me quarrel with my own Houſe for preſenting me with ſuch deteſtable Objects. No, *Madam*, anſwered I ſmiling, that is not my Intention, I would rather have you perſuaded that every Corner of it is ſince yeſterday become philoſophical.

Let us fix upon one Point in the Air to which your Eye and mine may be equally directed while we are both looking at the ſame Time upon different Parts and different Colours of this Wall. Do you, for Inſtance, place yourſelf at this Pilaſter and look upon the red on the Veſture of *Achilles*. I will ſtand at the Window, and look upon the blue of the Sea, ſo that while you are looking at the red and I the blue, our Eyes may each be directed to the ſame Point of Air. It is certain that two Rays will paſs through this Point, one from the Robe of *Achilles*, and the other from the Sea. Theſe Rays yo

know

know are nothing but two Series or Strings of Globules immediately touching each other, the one continued from the Robe of *Achilles* to your Eye, the other from the Sea to mine. Theſe two Strings of Globules interſect each other in that Point which we have fixed in the Air, and conſequently in this Point there will be one Globule common to both Strings. Do you underſtand all this? Yes, too well, ſaid ſhe, and I begin already to tremble. In order for theſe Globules to excite Viſion in us, anſwered I, the Preſſure of thoſe contained in that String which comes from the Robe of *Achilles*, muſt be continued from thence to your Eye, and the Preſſure of thoſe contained in that String which comes from the Sea muſt from thence be continued to mine. Now that Globule, which happens to be in the Point of Air where the two Strings interſect, and which is common to each of them, muſt at the ſame Time preſs towards your Eye and mine, which is utterly impoſſible if the Globule be hard, as *Des Cartes* ſuppoſes it to be; becauſe

becauſe the cloſe Union of the Parts of ſuch a Body can never ſuffer it to preſs at the ſame Time towards two different Sides. But this is not all. — And yet this is ſufficient, ſaid the Marchioneſs, to demoliſh my Globules. The very ſame Globule, ſaid I, as hard as it is, muſt have at the ſame Time two different *Rotations*, one to excite in you the Idea of a red Colour, which is communicated to the whole String that comes from the Robe of *Achilles* to your Eye, and the other to excite in me the Idea of an azure Colour, communicated to the whole String that comes from the Sea to my Eye. But the Difficulty will be ſtill greater if we ſuppoſe other Spectators to be placed in this Gallery, who all direct their Eyes to the ſame Point in the Air as we have fixt upon, and other Rays to paſs through this Point, ſome of which ſhould convey the golden Colour of *Achilles*'s Hair, that *Minerva* lays hold on in order to calm his deſtructive and impetuous Rage; others the green of this Meadow, and the innumerable other

other Colours which variegate the Picture. You ſee then, that ſuppoſing your Globules, ſuch as *Des Cartes* has made them, it would be impoſſible for us to ſee what, however, we really do ſee. I underſtand this but too well, anſwered ſhe, but I beſeech you, for the Love of Philoſophy, never mention theſe Globules to me again. I am reſolved to think no more of them ſince they have ſo ſhamefully yielded to the very firſt Difficulty. They ſeem to reſemble thoſe unexperienced Lovers, who at the firſt Repulſe think of a Retreat. But pray let me ſee what your reformed *Carteſian Malebranche* ſubſtitutes in their Place; for I am perſuaded he will be able to make a better Reſiſtance.

Malebranche, anſwered I, entirely rejects theſe ſolid Globules which you have forbid me to mention, and ſubſtitutes in their Place certain exceeding ſmall and fluid *Vortices* compoſed of an ethereal and very ſubtile Matter, which fills all the great *Vortices*, as the great *Vortices* which are the Seats of Stars and Light do

the Univerſe. Theſe little *Vortices*, by that Power which they have of dilating themſelves, keep a mutual *Equilibrium* in their reſpective *Vortices*, juſt as the great *Vortices* do in the Univerſe. In this Syſtem of *Malebranche* Light is nothing but the Undulation or Vibration of the *Vortices*, occaſioned by the Vibration of the luminous Body which is always repelled in the ſame Moment that it impels, and the greater or leſs Force of the Light depends upon the greater or leſs Force of theſe Vibrations, juſt as Colour depends on their greater or leſs Velocity. For Inſtance, if theſe *Vortices* ſhould raiſe fifty Vibrations upon the Optic Nerve or the *Retina* in any determinate ſpace of Time, it would give us the Idea of a certain Colour; if in the ſame Time there ſhould be a greater or leſs Number of Vibrations raiſed, we ſhould have the Senſation of a different Colour. *Malebranche* ingenuouſly confeſſes however, that he was not able to aſſign what determinate Degrees of Quickneſs were neceſſary to form different Colours in particular. A Confeſſion

ſeſſion ſo much the more ingenuous as it is extraordinary in a Philoſopher.

This Syſtem of Light and Colours has a very great Affinity with that of Sound, with this Difference only, that Air is the Vehicle or Channel of the one, and the ethereal Matter or the *Vortices* compoſed of that Matter, the Channel of the other. The Vibrations, which a ſonorous Body when it is ſtruck raiſes in the Air, and from thence in the auditory Nerve, excite in us the Idea of Sound. In the ſame manner the Vibrations which a luminous Body raiſes in the ethereal Matter, and from thence in the Optic Nerve, excite in us the Idea of Light.

If the Air be entirely excluded from any Place (which may be done by the help of a certain Machine) a ſonorous Body put into that Place would not be heard to ſound. In the ſame manner if it were poſſible to exclude the ethereal Matter from any Place, a luminous Body put into that Place would not appear reſplendent.

The

The greater or leſs force of the Vibrations on the Air, or the auditory Nerve, produces a greater or leſs Intenſeneſs of Sound. In the ſame manner the greater or leſs Force of the Vibrations on the ethereal Matter, or the optic Nerve, produces a greater or leſs Intenſeneſs of Light.

The different Quickneſs of the Vibrations on the Air, or the auditory Nerve, produces different Sounds, as Baſs, Treble, and their different Degrees: So after the ſame manner the different Quickneſs of the Vibrations raiſed in the ethereal Matter or the Optic Nerve produce different Colours, as red, yellow, and the like, which may be conſidered as the *Tones* of Light.

I do not believe, ſaid the Marchioneſs, that even our Preachers ever carried a Similitude farther than this. It may be carried ſtill farther, anſwered I. As various and different Vibrations croſs and interſect without deſtroying, or rather without giving each other the leaſt Interruption, which we every Day ſee in Conſorts of Muſic, where the Vibrations

Vibrations of the Strings of a Violin do not interrupt thoſe of any other Inſtrument) ſo the different Vibrations which flow to our Eye from different Colours, do not interrupt each other, notwithſtanding they croſs and interſect. The Fluidity of theſe *Vortices* gives them a Power of tranſmitting the Vibrations, of different Colours to various Parts, (which the Solidity of the Globules would not ſuffer them to do). In the ſame manner as the Fluidity of the Air does the different Sounds in a Concert of Muſic. The Explication of this ſeems ſo very difficult to *Malebranche*, that he affirmed a Syſtem capable of effecting it, muſt be conformable to Truth.

Sound and Light, replied the Marchioneſs, appear to be as faithfully copied from each other, as Nature was by the Paintings of *Apelles*, which were ſo very accurately done, that an Aſtrologer could predict the future Fortune of the Perſons whom they repreſented.

I have not yet finiſhed the Compariſon, anſwered I, an Object placed be-

tween two Looking-glaſſes over-againſt each other, will be greatly multiplied. One Candle is changed into a thouſand, and brings to mind the celebrated annual Feaſt of the Illumination of Candles among the *Egyptians*, from which ſome imagine the *Chineſe* to have borrowed their Feaſt of Lanthorns. And does not the famous Echo of the Caſtle of *la Simonetta* not far from *Milan*, produce the very ſame Effect upon Sound? The Report of a Piſtol in this Place is repeated more than forty Times, and a ſingle Inſtrument of Muſic forms a Fulneſs of Sound ſuperior to that of the moſt numerous Concert. Two great Wings of a Building oppoſite to each other with Windows, which are all falſe except one, and formed of a Matter very proper to throw back the Vibrations, reflect and multiply the Sound juſt as the two Glaſſes do the Candle.

The great Lord *Bacon*, the Harbinger of true Philoſophy, has among innumerable other curious Things propoſed the Examination of this Affinity betwixt Light and Sound to the Conſideration

ſideration of Naturaliſts. Perhaps he could not have wiſhed to find a more cloſe Union betwixt them, than what the Syſtem of *Malebranche* diſcovers. But he adviſed too that Philoſophers ſhould carefully examine in what Points they might diſagree; and the greateſt Difference betwixt them is, (as I firſt told you), that the Channel of Sound is the Air, and that of Light the ethereal Matter. Hence it follows that Sound muſt be propagated from a ſonorous Body in Time, for the Spaces and Interſtices between the Particles of Air make it abſolutely neceſſary, that there ſhould be ſome little Time before the Motion can be communicated from one Particle to another. Light on the contrary muſt be propagated in an Inſtant, or an exceedingly little Space of Time, becauſe there are no Spaces betwixt the *Vortices* or ethereal Matter, ſince the whole Univerſe is every where filled with them. Light and Sound have the ſame Reſemblance to each other as the *Nereids* engraved by *Vulcan* upon the Silver Gates of the Sun's Palace, in

Ovid's Metamorphoſes. Their Features are not exactly the ſame, but ſo extremely like, that it is very eaſy to perceive they are Siſters.

Let us then become reformed *Carteſians*, ſaid the Marchioneſs, by accepting a Reformation which not only explains all that the Globules did, but ſomething more, and of much greater Importance, which they were not able to explain. Let us adopt *Malebranche's* Syſtem of Light and Sound, theſe two new Brothers in Natural Philoſophy. I do not abſolutely deſpair, anſwered I, but the Harpſicord of Colours, and the Muſic of the Eyes, which gives a ſtill greater Confirmation to this new Alliance, may in Time meet with a favourable Reception from you.

What do you mean, replied the Marchioneſs, by this new invented Muſic and Harpſicord? Have you a Mind to ridicule the philoſophical Similitude you have been entertaining me with? I ſhould be very ſorry, anſwered I, to have any Temptation to ridicule what you have adopted inſtead of your Globules.

Globules. This Harpſicord is indeed a new Invention, but is not therefore the leſs true or real. Upon moving the Keys of this Inſtrument, inſtead of hearing Sounds, you will ſee Colours and Mezzo Tintos appear, which will produce the ſame Harmony as Sounds do. The Sonatas of *Rameaux* or *Corelli* will give the ſame Pleaſure to the Eyes when ſeen upon this philoſophical Harpſicord, as they do to the Ear when they are played upon the common Sort. The Concords of a Piece of Purple and Scarlet will raiſe the Paſſions of Love, Pity, Courage, or Anger in our Souls: This ſurprizing Inſtrument is now making beyond the Mountains, and you may for the future expect your Silks and Ribbons in Muſic. The tranſient Pleaſures of the Ear will be fixed in the Eye; you may continually enjoy the fine Airs of *Farinelli* wove in a piece of Tapeſtry.

The Inventor, anſwered ſhe, probably took the firſt Idea of this, from the Dreſs of a Harlequin. However, we are greatly obliged to him, for we ſhall

have no occaſion to embarraſs ourſelves for the future in adjuſting the Colours of our Clothes. We need only conſult the Thirds and Octaves of this Harpſicord, and we ſhall be ſure never to make any Diſcord in the Shading. The Painters, anſwered I, may find Relief in their Indiſpoſitions from this new invented Muſic of Colours, as Singers and Muſicians are ſaid to do from that of Sounds.

Why will you reſtrain the Effects of ſo ſingular a Thing (ſaid ſhe) to the Painters only? It will help Phyſicians to increaſe their Preſcriptions and prolong their Conſultations. Phyſicians, anſwered I, muſt act with regard to their Patients, as Muſicians do with weak Voices, and as thoſe are careful not to diſcourage their Scholars with difficult Notes, ſo theſe in certain Diſtempers, as the Bite of a *Tarantula*, which can be cured only by Pleaſure, muſt take Care not to preſcribe any Colours for which the Patient has an Averſion. But we muſt leave the Phyſicians to divert their Patients in this new Method as they

they judge proper. This new Inſtrument will help to give us a Proof of the Juſtneſs of that fine Compariſon made by an elegant Poet between the gradual languiſhing and dying Sounds in the Voice of our tuneful *Orpheus*, and the inſenſible fading and vaniſhing of the Colours in the Rainbow. Who knows replied the Marchioneſs, but we may ſome Time or other form a Dinner by the Aſſiſtance of a Harpſicord, and find Harmony in a Fricaſſy?

After this Diſcourſe, as we were taking the Air in the Garden, the Marchioneſs ſuddenly cried out, — What ſhall we do? I ſee a Gentleman in our Neighbourhood coming towards us, who in every Viſit he makes does me the Favour to repeat Sonnets by the hundred, and yet always finds Time for ſome Ode. How ſhall we diſengage ourſelves from his troubleſome Company? Will there be no *Vortex* ſo merciful as to ſnatch him away with itſelf, and remove him from our Syſtem? For want of a *Vortex*, anſwered I, we will ſerve him as I once

did a Mathematician, who happens to be very talkative, a Fault which thoſe Sort of People are ſeldom guilty of. When you are walking with a Friend and diſcourſing about the Country of *Kouli Kan* or ſome ſuch Trifle, he will entertain you with the moſt abſtruſe Points in *Geometry*. He aſſaulted me one Day as I was walking with ſome Company in a Garden, and we preſently found by his Air that he was preparing to torment us with his Demonſtrations and Corollaries. I and the others which were with me began to talk of Poerty, and repeat Verſes, (a Language to which he was an utter Stranger) without ſuffering him once to open his Mouth. By this Means we compaſſed one of the moſt difficult Enterprizes, that of tiring the moſt tireſome Perſon in the World. Now we need only continue our Diſcourſe upon Philoſophy, and I will engage your Sonnetteer will ſuffer the ſame Puniſhment as my Mathematician. Thus we reſolved to proceed.

After the firſt Compliments were over, the Poet, who knew nothing of

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our Scheme, took occaſion to inform us that the *Muſes* had for a long Time uſed him ill, and that he was reſolved to renounce them forever. After we had civilly contradicted him, he anſwered that he was ready to prove his Aſſertion by a few Sonnets which he had lately made, and which would ſhew us, how very little he was in their Favour. If they are really ſo perverſe, ſaid the Marchioneſs, taking him at his Word, you muſt intirely abandon, and never think of them again. We have juſt been diſcourſing on Philoſophy and Optics, it will be taking an effectual Revenge if you enter into our Converſation, which is ſo very different from Poetry. He excuſed himſelf by ſaying that he had not a Capacity for ſuch ſublime Subjects, and though it was neceſſary ſometimes to ſhew a little Reſentment, he muſt take Care not to affront the Muſes too much. He obſerved that a little Poetry would alleviate the Severity of our philoſophical Diſcourſes, and alledged the Example and Authority of *Plato*, who did not think it beneath

beneath him to write Love Verſes to *Agatis*, and engrave the three Graces on the Citadel at *Athens*, with the ſame Hand with which he had wrote the Inſtitutions of his Republick and the *Timeus*, and in this manner divided his Time between Philoſophy and the Arts of *Apollo*. But all theſe Arguments could not prevail on us to let him repeat his Sonnets, which was the chief Deſign both of his Viſits, and all that Erudition which he had laviſhed upon us.

The Marchioneſs aſked me ſeveral Queſtions, which our Poet did not think at all a Propos. Among the reſt, ſhe was very anxious to know whether ſhe might rely upon *Malebranche*'s Syſtem of Light and Colours; for the Deſtruction of the Globules made her fear every Thing, and her Suſpicions were terribly increaſed by this Harpſicord. I anſwered, that ſuch was the Condition of all human Things, that nothing muſt hope for a long Duration here below, a Truth which our Gentleman could evince by many fine Verſes of the beſt

Poets,

Poets, and perhaps by ſome of his own. I added, that I was extremely pleaſed to find the Example of the Globules had warned her not to place too much Confidence in the Reformation of Father *Malebranche*. But that the moſt fatal Blow to this Opinion was, the being obliged to forſake it upon the Account of that very Analogy and Correſpondence betwixt Light and Sound, which at firſt ſeemed to give it ſo much Luſtre.

This Analogy, continued I, fails in one of the Parts, and in that Part where it was moſt wanted. And this Circumſtance is ſufficient to overthrow *Malebranche*'s reformed Syſtem. All thoſe fine Reſemblances, which you obſerved with ſo much Admiration, cannot ſave it from Deſtruction.

If an undulating Motion happens to meet with any Obſtacle in its Way, this does not ſtop its Progreſs, for it bends on all Sides, and continues to propagate itſelf in Spite of the Obſtacle that oppoſes it.

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A very familiar Example will make you underſtand what I mean. If we were at the Bottom of this Hill, and ſome Perſon on the oppoſite Side of it ſhould ſound a *French* Horn to proclaim the Deſtruction of ſome innocent Tenant of the Woods, whoſe only Fault is the Pleaſure we find in deſtroying him by the help of our Reaſon and Contrivance, we ſhould hear this Sound notwithſtanding the whole Hill is placed betwixt the Horn and our Ear. The Reaſon of this is, becauſe the Undulations raiſed in the Air by the *French* Horn do not ſtop their Progreſs when they meet with the Hill, but giving Way on every Side and bending all round it, communicate the like Vibrations to the oppoſite Air. After the ſame manner if you throw a little Stone into this Baſon, the Undulations formed in the Water will not ſtop when they meet with the Pipe, but giving way all round it, will communicate themſelves indifferently to all the Water, and thus the Effects of it will be diſcovered in the whole Baſon.

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You ſee then that if Light were nothing but an Undulation of the ethereal Matter communicated to it by the Vibrations of the lucid Body, no interpoſed Body could ever deprive us of the Light of the Sun or any other luminous Object, or in other Words we ſhould never have any Shadow, which (eſpecially in this Seaſon,) would be a terrible Inconvenience brought upon us by *Malebranche*'s Syſtem. The Preſſure of *Des Cartes* Globules could give us no Aſſiſtance in this Caſe.

Thus Sir *Iſaac Newton*, the avowed Enemy to imaginary Syſtems, and to whom you are indebted for the true Idea of Philoſophy, has at one Blow lopped off the two principal Heads of the reviving *Carteſian Hydra*.

Though the Marchioneſs perceived the Force of this Argument, ſhe did not ſeem greatly dipleaſed with it. As ſhe had renounced the Globules, ſhe eaſily gave up the *Vortices*. But our Sonnetteer was not quite ſo well ſatisfied. As he could find no Opportu-

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nity of diſcharging his poetic Fury, he was obliged to go ſome where elſe, to find an Audience to a Satyr which it is very probable he had begun to compoſe againſt Philoſophy.

End of VOL. I.

MVSEVM BRITAN NICVM

BOOKS *juſt publiſh'd.*

TRAVELS into the Inland Parts of *Africa*; containing a Deſcription of the ſeveral Nations for the ſpace of ſix hundred Miles up the River *Gambia*; their Trade, Habits, Cuſtoms, Language, Manners, Religion and Government; the Power, Diſpoſition and Characters of ſome Negro Princes; the Country and Hiſtory of *Job Ben Solomon*, a *Pholey*, who in the Year 1733 was in *England*, and known by the Name of the *African*. To which is added, Captain *Stibbs*'s Voyage up the *Gambia* in the Year 1723, to make Diſcoveries; with an Accurate Map of that River taken on on the Spot, and the Soundings for 500 Miles: And many other Copper Plates curiouſly engraved. Alſo *Extracts* from the *Nubian*'s Geography, *Leo* the *African*, and other Authors ancient and modern, concerning the *Niger*, *Nile*, or *Gambia*, and Obſervations thereon. By *Francis Moore*, Factor ſeveral Years to the Royal *African* Company of *England*. Printed by *Edward Cave*, at St. *John*'s *Gate*, *London*, for the Author, and ſold

by *E. Comyns*, at the *Royal-Exchange*; and the Bookſellers in Town and Country, 1739.

Where may be had,

1. Memoirs of a Man of Quality: Written originally in the *French* Tongue by himſelf, after his Retirement from the World.

2. The Hiſtory and Antiquities of *Kings Lynn* in the County of *Norfolk*, (With a View of the Town, and ſeveral other Copper Plates ſerving to illuſtrate the Hiſtory, neatly engraved) wherein is contained, whatever is or hath been curious or remarkable in this Town. With a Chronological Account of the Memorable Occurrences for 500 Years paſt to this preſent Time. By *B. Mackrell*, Gent.

3. An Examination of Mr. *Pope*'s *Eſſay on Man.* Tranſlated from the *French* of M. *Crouſaz*, Member of the Royal Academies of Sciences at *Paris* and *Bourdeaux*, &c.

4. The Satyrs of *Perſius*, with the Original *Latin* annexed. Illuſtrated with Annotations for the Uſe of Schools.